I/O News

Structural Computer Aided Design Analysis
Development of a Parallel Port Adapter
New Family of Computer Products

THE OFFICIAL PUBLICATION OF THE INTERNATIONAL ASSOCIATION OF CROMEMCO USERS

Volume Two, Number Four

Single Copy Price $7.50

Supermini Capability at Micro Prices

Cromemco Expands Product Line With New Family of 68000-Based Boards

With the introduction of its 68000-based board family, Cromemco makes supermini capability available on microcomputers. And, at micro prices.

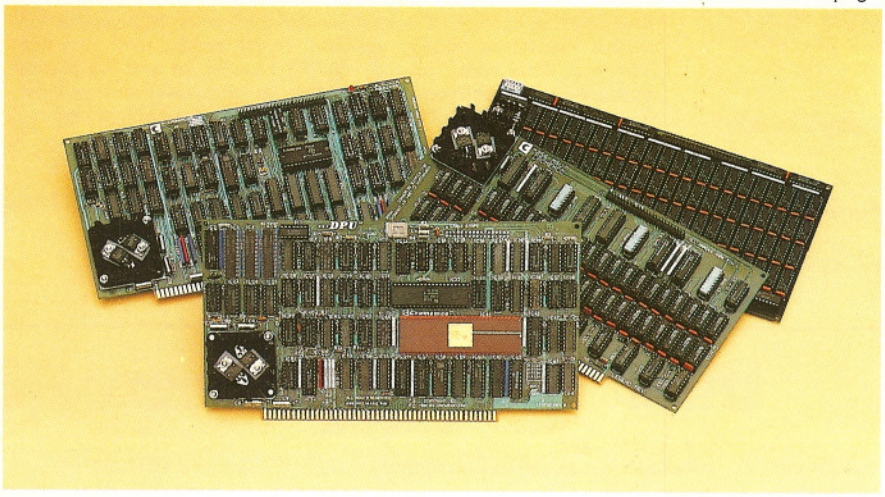
The heart of the system is the new **Dual Processor Unit** (DPU), which combines the powerful 68000 processor with the existing Z-80A processor on a single S-100 board. The inclusion of the Z-80A on the new board was a well thought move ensuring compatibility with the large library of existing programs already available for Cromemco systems. It allows an inexpensive upgrade path for current users of Cromemco systems.

The 68000 was selected as the central processor for the new product line because of its advanced 32-bit wide architecture and enormous 16 megabyte addressing range. No other microprocessor has these features. The 68000 has 56 main instruction types, five main data types, and 14 addressing modes which combine to create over 1000 different instructions. Obviously, the power and potential are vast.

Complimenting the new DPU and rounding out the new board family, are a **Memory Controller Unit** (MCU), and a choice of either a 256K RAM board (256MSU), or a 512K RAM board (512MSU). The 256MSU and 512MSU provide built-in Error Checking and Correction (ECC) to ensure smooth, reliable performance. Each board uses 22 bits to encode each 16-bit word providing ECC via a modified Hamming code. This code provides transparent detection and correction of single-bit errors, and detection of double-bit errors.

The MCU can control up to eight

Continued on page 8



Putting Your Data Files In Order

by Jim Gunkel

I have been using Cromemco's Data Base Management System (DBMS) and Data Base Reporter (DBR) programs quite extensively recently and have developed a technique that might be of interest to other users of these programs. Anyone who builds a data base over a period of time from multiple input sessions should benefit from my observation.

The "problem" is the type that slowly occurs during normal system use. Often it is not directly recog-

Continued on page 12

Not Just A CDOS-CP/M Simulator, But...

by Michael A. Mellone

Several software firms are now providing CP/M 2.2 simulators for use with the CROMIX Operating System by Cromemco. One firm, Gunn Enterprises Inc., of Houston, Texas, has written one that is unique and offers some powerful features not found in any of the others. Simulating CDOS and CP/M is just a small part of the GEI Simulator; its main purpose is to extend the capabilities of CDOS-CP/M programs. Designed to replace the standard simulator, its operation is transparent to the user.

There are many features found in the GEI Simulator. Some of the more

Continued on page 10

ENHANCE YOUR CROMEMCO DISK OPERATING SYSTEM WITH USD'S CDOS UTILITIES

DON'T GET CAUGHT PLAYING WITHOUT A FULL DECK!

CONTENTS OF USD's CDOS UTILITY DISK

Adir

Displays an alphabetical directory of any CDOS disk, including hard disks. This program is similar to Cromemco's STAT/A, but operates up to TEN TIMES FASTER than STAT/A, especially on the hard disk. Also displays the following useful disk information: disk label, disk date, maximum directory entries, directory entries available, number of files displayed, number of file extents, file Kbyte total, and file Kbytes free. Allows printing a continuous alphabetical archival directory, which cannot be performed with Cromemco's STAT.

CLmap

Displays a cluster map of any CDOS disk, including hard disks. May be used to identify the contents of any disk cluster, or to display the cluster map of any disk file, showing the file's clusters relative to the total disk cluster map. Ambiguous file references are allowed. Identifies all directory entries, including extended (normally transparent) directory entries on hard disks. Useful for re-packing a disk for fastest operation of often-used programs.

Comline

Programmer's aid in interpreting the CDOS command line. Displays all information at default FCB-1 and FCB-2, and command line buffer. If you are programming in assembly language for CDOS or the Cromix CDOS simulator, you should not be without this program. There is never any question as to how the command line will be interpreted: what you see is what you get.

Dstat

A very fast routine to display disk status information for any CDOS diskette, or CDOS hard disk. Operates up to TEN TIMES FASTER than Cromemco's STAT or STAT/B. Displays the following information: disk FORMAT label, disk directory label, disk date, directory entries left, directory entries used, maximum disk directory entries, file space left, file space used, file space used for hard disk extended directory, and maximum disk file space. This utility is normally supplied with USD's SuperCopy I.

DT

Displays and/or sets CDOS date and time. The time function requires a hardware real time clock, such as that built into the Cromemco 3102 terminal, or any other hardware clock, with appropriate I/O software. This program is much faster than Cromemco's STAT/DT for setting and/or displaying CDOS date and time.

DumpRCD

Provides an ASCII/Hex dump of CDOS file records. Similar to Cromemco's DUMP, with the following additional enhancements: display record-at-a-time or continuous ascending display; start dump at any desired file record or address; choice of new starting record or address may be made without reloading program.

Edir

Similar to Adir, but displays only ERASED entries. This utility is normally supplied with USD's RESTORE.

Eject

Remotely eject any one diskette, or all diskettes in Cromemco's 8 inch (PerSci, Inc.) drives.

*All programs require a Cromemco computer operating under CDOS 2.36 or higher.

Pdt

CDOS I/O printer driver with perpetual calendar, for use with Cromemco's 3703 (Centronics 703) or TI-810 printers. May also be used with any "Centronics compatible" printer capable of responding to an ASCII form feed. This I/O driver will format any desired number of lines on a page and print the page number on the bottom of each page. Prevents printing over page perforations on continuous form paper. When used with a hardware clock, such as in the Cromemco 3102 terminal, may be used to print the day of the week, date, and time. Pdt.Com is an executable program which automatically installs a CDOS resident I/O driver. When used with Sdt.Com, you may instantly select between a parallel printer and a serial printer.

RAW

Turns CDOS Read-After-Write on or off. Turning RAW off can more than double the effective read/write speed of Cromemco's floppy diskettes. A viable method for increasing the speed of ASCII editors and word processors. If you want to exceed the speed of CP/M systems, but retain the advantages of Cromemco's CDOS, this program is for you.

Read

Allows rapid examination and string search of large ASCII files. Designed to be used with the Cromemco 3102 terminal, operating under CDOS. Read.Com provides forward and backward scrolling, continuous, line-at-a-time, or page-at-a-time viewing, and rapid movement forward and backward thru a file. Provides choice of ten different scroll speeds. May also be used to print an entire file, or just one screenful at a time. In the search mode, this program can locate a desired string in a 100 Kbyte file in less than five seconds! Useful applications: rapid search and examination of large ASCII data base files (e.g. telephone directories, employee data records, etc.); rapid search and examination of large ASCII source files for any programming language. Read.Com provides all of the ASCII file search and examination flexibility of a sophisticated editor or word processor but at up to 50 times the speed, with the additional advantage of small command file size (6 Kbytes), and the ability to print all or selected portions of a file. Most users of Read.Com rarely use the CDOS "TYPE" command.

Replace

Provides rapid, trouble-free search and replace of any desired ASCII string in any CDOS file. Useful for customizing or changing sign-on messages, version numbers, etc.

Sdt

Similar to Pdt, but for use with serial daisy-wheel printers such as the Diablo 1600 or Xerox 1700 series, Qume Sprint 5-9 series, or compatible NEC printers. Provides bidirectional, optimized thruput printing when using these printers as CDOS system list (LST: or PRT:) devices. As with Pdt, provides perpetual calender and system clock printout. Requires UART serial port hardware such as Cromemco's TU-ART, or the serial port on the SCC/d single card computer.

Sector

Displays an ASCII/Hex dump of any physical or logical CDOS disk block or sector.

Speed

Measures the rotational speed of Cromemco's hard disks.

WHAT IT COSTS

$195.00 For immediate air mail shipment.
New York residents add 7¼%.
Make checks payable to U.S. Dynamics Corp.

30 YEARS AT THE USD LEADING EDGE

We accept Visa and Master Card

HOW TO ORDER

Call collect or write. If calling, place calls during normal business hours, EST. Ask for software sales.

For INFORMATION or SUPPORT: Call collect. Ask for software engineering.

U.S. DYNAMICS CORPORATION 425 BAYVIEW AVE., AMITYVILLE, NEW YORK 11701 (516) 842-5600

MORE POWER TO YOU

With

"E-x-p-a-n-s-i-o-n Packs"

From The Leading Cromemco Dealer In America

16-Megabyte Hardpack **$8,995**

Cromemco users can now have 16-megabytes of storage with Control Data Corporation's Winchester technology Lark hard disk drive. Back-up storage is provided with 8-megabytes of fixed memory and 8-megabyte removeable cartridge.

Graphics Plotter Hardpack **$1550**

The new Hewlett-Packard 7470A 2-pen plotter is a perfect complement to any Cromemco computer system. Designed with an RS-232 interface for easy connection, the "Sweet Lips" plotter is engineered with H-P excellence to perform reliably for the life of your system.

MCS MENUtility Softpack **$195**

This Menu generator program provides a friendly, user-oriented menu system for CROMIX[1] users. Any desired set of application programs may be selected from an automatically produced "menu."

Matchmaker™ Softpack **$195**

Selectively search CROMIX and CDOS[1] ASCII files, match key words, and document their occurrence within each file. This convenient, time-saving program is extremely useful in a wide variety of applications ranging from researching a data base to performing powerful word processing tasks.

96-Megabyte Hardpack **$14,995**

Control Data Corporation's Phoenix hard disk drive with DMA industry-standard SMD controller and Cromix drivers from Intelligent Terminals Corporation can be added to your Cromemco system today. With 80-megabytes of fixed memory and 16-megabyte removeable cartridge for back-up, Cromemco users can expand their mass storage to accomodate most any requirements.

CPMSIM[2] Softpack **$195**

This CP/M[3] simulator program by Magic Circle Software (MCS)[2] allows CROMIX and CDOS users to run virtually any program written for use under the CP/M operating system.

MCS Tape Back-up Softpack **$195**

Drivers for ¼-inch cartridge tape drives for back-up of CROMIX-formatted disk drives include an interactive program which allows back up and restoration of individual files, directories and entire file systems, using full CROMIX path names.

LYNC[4] Communications Softpack **$195**

MCS adaption of a popular and very powerful communications package. Fully compatible with the original LYNC package, which includes the ability to send and receive Text and Binary data with checksums, and a Terminal Emulation Mode. For use under CROMIX, CDOS, or CP/M on Cromemco systems.

Computer Centers
of America

2129 Westheimer Houston, Texas 77098 (713) 527-8008
5401 Mitchelldale A3 Houston, Texas 77092 (713) 957-8787
2629 Stemmons Freeway Dallas, Texas 75204 (214) 638-4477

TWX 910-881-1597 CCA-ITC HOU

[1]CROMIX and CDOS are trademarks of Cromemco, Inc.
[2]CPMSIM and MCS are trademarks of Magic Circle Software subsidiary of CCA
[3]CP/M is a registered trademark of Digital Research Corporation
[4]MCS is licensed by Computer-Aide for sales of LYNC

table of contents

Volume Two, Number Four

I/O News The Official Publication of The International Association of Cromemco Users is available through membership in the association. Editorial and advertising policies are designed for the enlightenment of the members in regard to new uses for, and developments of, Cromemco products and other products compatible with Cromemco systems.

COVER FEATURES

ARTICLES & FEATURES

DEPARTMENTS

I/O News (ISSN 0274-9998) is published bi-monthly by The International Association of Cromemco Users (a California corporation), P.O. Box 17658, Irvine, CA 92713. General offices are at 4750 Von Karman Avenue, Suite 500, Newport Beach, CA 92660. Telephone: (714) 955-0432. Controlled Circulation Postage Paid at Santa Ana, CA. POSTMASTER: Send address changes to I/O News, P.O. Box 17658, Irvine, CA 92713.

Subscriptions to I/O News are entered with membership in The IACU. Yearly memberships may be purchased for $35 (U.S. delivery address), $41 (delivery address in Canada or Mexico), and $48 (other international delivery address). Contact IACU for multi-year membership rates. Back issues of I/O News are available for $7.50 per issue. Please note: all prices are in U.S. dollars.

Return postage must be included with all manuscripts and photos submitted if they are to be returned. The IACU and I/O News accept no responsibility for the return of unsolicited materials.

Richard Kaye
Editor and Publisher

Typography
Dynacomp, El Toro, CA

Printing
Shears Litho, Santa Ana, CA

input...

Editor:

When we spoke recently, you suggested that I write immediately so that my letter would reach the next issue of I/O News.

As I mentioned, I need a name and address mailing program that will accommodate several thousand names — both for a listing and for labels, three across.

I use a Cromemco 5¼" Double Drive System 780K total capacity, under CDOS.

I have written and called all over the United States looking for an adequate mailing program, but to no avail. The mailing programs that I did find either run under other operating systems, or on small personal computers inadequate to handle 30,000 names.

I am unable to use a hard disk at this time. I would like to find a user-friendly program that will sort by Zip code, and possibly one other field. One that is easy to maintain — updates, deletes, etc.

If any fellow IACU Member should have access to, or knowledge of, a program which can handle my chores, please call me collect, or write me. My request is quite urgent.

Thank you,
Lee Richardson
420 North Louise Street
Glendale, CA 91206
(213) 242-6666

Editor:

The Tec-Tips column is a very interesting and useful feature of the I/O News. In the Jan/Feb issue Richard Quinn addressed the problem of bringing up terminals (under CROMIX) which were off when the system was booted. The command file approach may be a preferred solution for some users, however, assuming TUARTS are involved, I believe there is a simple hardware solution for that and related problems.

The solution involves installing a 2,000 ohm resistor from pin 2 to −5 volts on each of the serial ports. Cromemco leaves a space between the two serial connectors for pads which are marked to indicate pin 2. I have installed the two 2,000 ohm resistors on the back of the board. Both resistors terminate on pin 24 of serial "A" connector, which is soldered to a large (−5 volt) trace (rear of board — third pin from pads).

I employ this method primarily so that, with a single terminal, I can directly access several processes which run concurrently. It works fine for either fixed or auto baud lines.

Sincerely,
Peter L. Andresen

Editor:

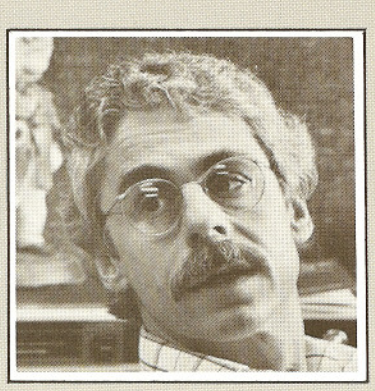
Perhaps you could help us in a technical matter and problem which could be put into the editorial because it may interest many other readers.

Our basic problem is, we want to connect a Remex and/or Qume drive instead of the PerSci. This is only possible with the 16FDC without many hardware changes. We modified the 16FDC (head load and seek complete lines) so that we are able to write and read from disk using the RDOS command for slow seek. There are no errors. But we are unable to boot CDOS or CPM and we believe it's caused by a too fast step rate of RDOS. The system just hangs itself without any error messages.

Maybe you or one of your readers has modified the soft- and/or hardware of Cromemco to fit the Remex or Qume drive. Since we cannot boot the system, we cannot modify CDOS or CPM for slower step rates. We believe that the RDOS is responsible for the original step rates and we have no manual or listings of RDOS or FDC drivers. Perhaps you can help.

Yours faithfully,
F. Swoboda
Kritzendorf, Austria

output



Big News

Many of the surveys we received indicated that the respondees want information on new products from Cromemco. (A few weren't interested.) Well, for those who do want to know, this year will be a big news year. Cromemco has released, or will be releasing, more hardware and software items this year than ever before. Most of these things have been in the works for several years and they are all coming together in 1982.

You will probably hear about these new products from other sources prior to reading about them in I/O News. But, we will bring you the in-depth articles that may not appear in other publications. Some examples are the DPU articles featured in this issue, and articles on the C-10, Cromemco's new terminal/personal computer scheduled for next issue.

Miscellaneous items of interest include the recent price reduction (effective June 15, 1982) in 64Kz cards, and the fact that the card has been modified and modernized. The new card, the 64Kz II, has fewer chips, a smaller heat sink, is wave-soldered on the connection side, and lists for only $695. The new price, of course, drops the total cost of CROMIX configured systems significantly.

Also, there will be the announcement of a new, low-cost, letter-quality printer — in the under $1,000 price range — as well as CDOS 2.52 which allows most CP/M 2.2 software to run, and CROMIX 11.9 which translates CDOS 2.52.

Where Is Our Book?

A fair question, and one that several survey respondees asked. Many of the sections of this book are as yet unwritten. Others are being organized for clearer presentation. What we are trying to avoid is a repetition of old issue of I/O News, although certain articles will appear in the book in conjunction with other articles on the same subject matter for a more complete picture. One other delay is occasioned by changes in technology. The longer we work on the book, the more certain sections change, and we want it to be as up-to-date as possible when printed. The most realistic estimate now is that it will not be printed until January, 1983 — one year later than originally anticipated.

Casualty Insurance in Force

The IACU EDP Policy is becoming more and more popular as members shop for insurance for their systems and compare premiums and coverage. So that all U.S. members have some basis for comparison, we have enclosed a flyer on the program with this issue. We hope this helps you acquire the proper protection.

The medical insurance policy is still not finalized. The fact is, the insurance companies simply do not like to be involved in this field. But, we have not given up. Keep those positive responses coming in via the survey cards and we will eventually overwhelm them with out numbers.

Preliminary Survey Results

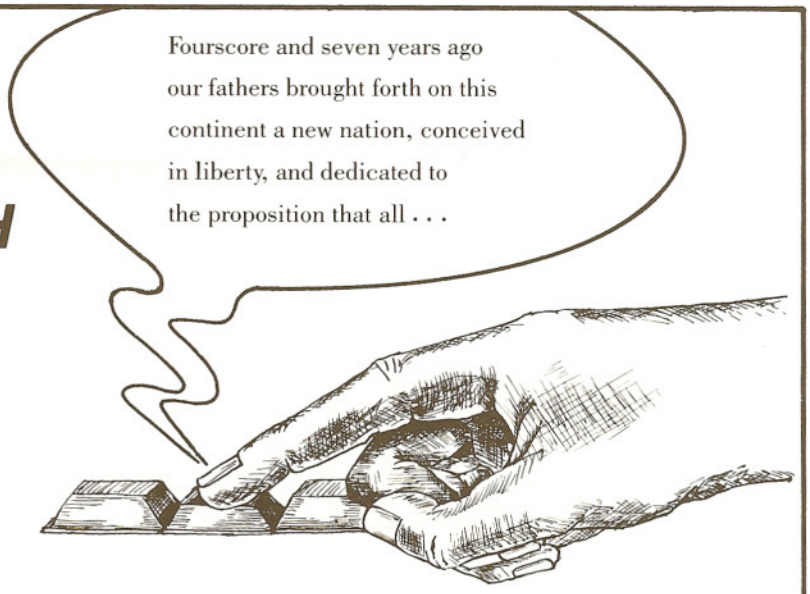
In addition to those items mentioned in this issue's "bits & bytes..." section, the survey responses were consistent in a few areas. Many members would like to see regular departments on 32K Structured BASIC, FORTRAN, and especially CROMIX. These will be done. In fact, the groundwork has been laid for us to commence in this direction with the next issue.

Also noted were requests for more applications articles. We have a nice inventory of articles at present, but we can't live forever on the ones on hand. Please...if you have, or know of, an interesting or unusual applications, let us know. Frankly, we can never get enough applications articles, as the potential uses of microcomputers are infinite. Each time someone shares a particular use, it gets the brainwaves flowing for another use. Keep those stories coming. Even if you do not feel like a polished writer, or do not have the time to fully develop an article, let us know. We will accept a fact sheet and work with you to develop a complete story so that others can receive the benefit of your experiences.

Richard Kaye
Editor

ONE TOUCH SAYS IT ALL WITH USD's

PROGKEY



USD's PROGKEY allows instant programming of the Function Keys on Cromemco's 3101 or 3102 terminals for enhanced performance in applications such as word processing, data entry, or source code programming.

PROGKEY WILL EFFORTLESSLY PERFORM THE FOLLOWING TASKS:

- Change the current programming of any one or all of the function keys in the RAM-resident CDOS, and display a complete function key table.

- Create an executable file which may be used to instantly define the CDOS resident function key programming to a predetermined SET of function key data. Additionally, this file may be programmed to automatically install its function keys whenever a particular program is in use: e.g. MicroPro's WordStar.

- Install the current programming of the RAM-resident function keys in the Cdos.Com file which is used to perform initial CDOS boot. This allows any desired SET of function key data to be available automatically upon boot up of CDOS.

- Produce two utility files for use by programmers: one for CDOSGEN use, and another for Z80 source file use.

WHAT YOU GET:

ProgKey.Com and four utility files, on 8 or 5 inch floppy diskette, comprehensive Users Guide, and one year's free software support.

SYSTEM REQUIREMENTS:

Cromemco computer operating under CDOS 2.36, or higher.

WHAT IT COSTS

$95.00 For immediate airmail shipment
New York residents add 7¼%
Make checks payable to U.S. Dynamics Corp.

30 YEARS AT THE USD LEADING EDGE

HOW TO ORDER

Call collect or write. If calling, place calls during normal business hours, EST. Ask for software sales.

We accept Visa and MasterCard
For INFORMATION or SUPPORT: Call collect. Ask for software engineering.

U.S. DYNAMICS CORPORATION 425 BAYVIEW AVE., AMITYVILLE, NEW YORK 11701 (516) 842-5600

Continued from Front Page

Cromemco Expands Product Line With New Family of 68000-Based Boards

memory boards. Each Memory Storage Unit supports either byte or word width memory operations. When used in conjunction with the error detection/correction MCUs, an error logging feature becomes operable. This feature stores the location of errors encountered, identifies which MSU generated the error, and which RAM chip on the MSU originated the error. This error logging feature provides systems users with exceptionally powerful diagnostic and preventive maintenance tools.

Major software packages designed for operation with the 68000-based systems include CROMIX, FORTRAN 77, COBOL 80, PASCAL, C, Structured BASIC, and a Macro Assembler. It is reasonable to anticipate that the hardware will be released in advance of much of the software, but Cromemco is working diligently to have many of these packages ready this year.

While the 68000-based CPU will not appeal to every user—Cromemco expects that its 8-bit systems will remain the primary products for some time—it will have immediate application for those in number-crunching situations, such as scientific computations or engineering analyses. These specialties have, hitherto, required mainframe or supermini power.

These new releases have once more reinforced Cromemco's reputation for compatibility. In fact, that very aspect of Cromemco's entire product line—the broadest in the industry—has probably delayed release of the 68000-based systems. But, the delay may have been worthwhile for those who are looking toward upgrading. With the addition of nothing more than three S-100 boards, the speed and capability of their systems can be significantly increased.

Cromemco has also introduced several system configurations incorporating the new 68000 board set. The company's popular desk top System One is available with a variety of options. A 68000-based System One, with dual 5" floppy disk drives, is available with either 256K or 512K of memory. With 256K of memory, the 68000-based System One (Model CS-1D2E) is available for a surprisingly low $5,495. WIth 512K, the System One (Model CS-1D5E) is available for $6,495.

Either of these System Ones can be upgraded to include a 5-megabyte hard disk drive as a substitute for one of the floppy disk drives. The 256K System One (Model CS-1HD2E) and 512K System One (Model CS-1HD5E) with optional 5-megabyte hard disk drives are available for $8,495 and $9,495 respectively.

Cromemco's System Three with dual 8" floppy disk drives is also available with the 68000. With 512K of memory, a 68000-based System Three (Model CS-3D5E) is available for $9,995.

The System One can be expanded to include up to 2 megabytes of memory and the System Three can be expanded to include up to 4 megabytes of memory. The price of a System Three with 4 megabytes of error correcting memory is less than $30,000.

For those planning to upgrade their present systems, the suggested retail prices for the boards are:

Dual Processor Unit (Model DPU)	$ 995
Memory Controller Unit (Model MCU)	495
256K Memory Storage Unit (Model 256MSU)	1995
512K Memory Storage Unit (Model 512MSU)	2995

The new boards will be released concurrent with this issue of I/O NEWS. Active Cromemco dealers have already received advance information on both the boards and the forthcoming software.

Software Packages That Really Deliver.

Custom CDOS I/O Drivers

- Terminal I/O with function keys
- Printer, Reader/Punch for your system **$195**

Custom WordStar I/O for CDOS

- Terminal I/O with programmable function keys
- Direct printer output **$195**

with WordStar $595

ASKARI for CDOS/Cromix

- Prohibits 32K Structured BASIC programs from listing **$595**

Custom WordStar I/O for Cromix

- Terminals have programmable function keys
- Function key files read/write
- Plus many other important functions **$295**

with WordStar $695

CDOS-CP/M Simulator for Cromix

- Automatic configuration for your terminal
- Automatic function key loading
- Line editing with WordStar commands
- Line buffering—up to 255 lines
- Printer selection (up to 4 printers)
- Plus many other functions **$595**

Modem Communications for Cromix

- Cromix to Cromix binary file transfers
- Capture all terminal output in a file
- Transfer/Receive file on other systems
- Interactive terminal mode
- Plus many other functions **$595**

Custom Cromix and Utilities

- Extended search paths (/usr/bin, ../bin)
- Custom Printer Drivers include:
  SER Standard Serial, XON/XOFF, ETX/ACK, Hardware Ready Line Printers, Centronics Compatible Parallel
- Utility Programs including:

SU	Sets user ID—Replaces priv
SuperCopy II	Cromix/CDOS floppy disk copies
Crypt	Encrypts/decrypts files
Filter	Filters characters in file
Lister	Lists files with headings

More than 50 others **$595**

Offer varies in Houston Area
Available only from
Gunn Enterprises, Inc.
NO DEALER DISCOUNT
Call for further information
713 / 871-8112

The Cromemco Specialists

Gunn Enterprises, Inc. • Houston, Texas • 713/871-8112

Not Just A CDOS-CP/M Simulator, But...

Continued from Front Page

powerful ones are:

User programmable function keys
Input line editing
Input line storage & recall
Dynamic printer controls
No EOF characters (^Z) at end of file
Mixed file access modes
Full CROMIX path names
Fork a shell process

The GEI Simulator supports the FUNCTION KEYS on the Cromemco 3102 as well as on all commonly used terminals. Special provisions have been made for those terminals without function keys, which enables a pseudo function key operation using the Control ^ (^^) as a function lead-in key. Each function key may contain a maximum of 128 characters, and may be changed by the console operator at any time during program execution. Once the function keys have been programmed as desired, they may be saved to a disk file. The file may be automatically loaded every time the program is executed. In fact, a different set of function key definitions may be created for each program to be executed under the simulator.

With this simulator, function keys may be used for program input. If you program the function keys with your most frequently used data, you can save a great deal of time during data entry.

The simulator's INPUT LINE EDITOR makes data entry a breeze. When you are entering a line of data, the simulator allows interactive editing on that line. For instance, you can exchange or delete characters, and even insert new characters within the input line. If you are familiar with WordStar's editing features you will find these line editing commands very easy to use, since the control keys used by the GEI Simulator and WordStar are the same. After you hit the return key the simulator automatically saves the line that you just typed into its CIRCULAR BUFFER and also returns a copy of the line to your program. The next time the program calls for input, you may enter a new line from the keyboard, or you may retrieve from the circular buffer any previous line that you have entered. Up to 255 lines can be stored and retrieved.

If your program has rejected a line of input data, it is very advantageous to be able to retrieve that line of data without re-entry. Once the line has been retrieved you can use the editing capabilities to correct the data and pass it back to the program.

PRINTER OUTPUT may be sent to one of four printers by changing the CP/M I/O byte (0003h). The simulator enables this to be done directly from the keyboard or under program control. If no device driver exists or the currently selected printer is busy, a special disk file will automatically be created in the local directory and all output to the printer will be sent to that file. This special file may be spooled to the printer at a later time. This feature alone can save you hours in produc-

tion time if a situation exists where you would like to run several programs, all of which produce printer output.

The simulator eliminates EOF CHARACTERS (^Z) from the end of user disk files. Under CDOS and CP/M all disk file read/write functions use a fixed record size of 128 bytes. When a program needs to write less than a full record, it will normally fill the remainder of the record with an end of file character (control Z). However, under the CROMIX Operating System, files may be of any length and the end of file characters need not be written. When a program running under the GEI Simulator closes a disk file, the end of file characters will be automatically stripped from the last record in that file.

There are several advantages in the elimination of the EOF characters. First, you can free up to 127 extra bytes for each data file. Also, when examining files with a screen editor, such as Screen or WordStar, you won't clutter up the screen with generated Control Z's. Most importantly though, many terminals other than the Cromemco 3102 interpret the control Z as a clear screen. When examining files with imbedded Control Z's, it can be a real nuisance when these Control Z's are constantly clearing the screen.

The GEI Simulator allows MIXED CROMIX FILE ACCESS MODES. When a program calls the simulator to open a file, it will first attempt to open the file for read and write access. If the file cannot be opened for read and write access, it will then be opened for read only access. If the user program attempts to write to a file which has been opened for read only access, a diagnostic error message will be displayed and the program will be aborted. Malfunctioning or untested programs can no longer clobber critical production files.

To determine a files location, the GEI Simulator allows references to the CDOS-CP/M drive disk letters in one of two ways. The first method uses the drive disk letters as pseudonyms for FULL CROMIX PATH NAMES. The CROMIX pathnames(s) may be specified in a special control file name '.profile'. If this file exists, it will be searched for a match to the drive disk letter. If a match is found, the string following the equal sign will be used as the CROMIX directory to be searched.

For example, if the file '.profile' contained the line

B: = /USR/BASIC

when a program opened the file B:TEST, the simulator will use the pathname

/USR/BASIC/TEST

If in the case above, no match has been found for the disk letter, the simulator will default to the CROMIX standard and use the pathname

/B/TEST.

This simulator feature lets you take full advantage of the CROMIX Operating System by giving you the ability to organize your data files under directory names that are more relevant to the data that is contained in that directory. For example, data files dealing with customer accounts could be in a directory called CUSTOMER ACCTS rather than just the letter B or C, etc.

The GEI Simulator will allow you to FORK A SHELL PROCESS through the console keyboard if your user ID is less than 100. This feature puts the program you are currently running to sleep without terminating it and returns you to the CROMIX command level. Once you have forked a shell, you may then execute additional commands, examine files, and even start a background task running, provided there is enough memory available. When you are ready to return to the original program, you may do so by just entering the EXit command. The simulator will then return you to the precise point in your program where you were at the time you forked a shell.

These special features included in the GEI Simulator are operational enhancements designed to allow CDOS-CP/M programs to take full advantage of the extended capabilities of the CROMIX Operating System. Used properly, these enhancements will in no way conflict with the normal execution of user programs, and will add greater flexibility to your CDOS and CP/M programs. Also, it allows execution of previously unexecutable CP/M 2.2 programs under the powerful CROMIX Operating System.

If you wish to obtain more detailed information on the GEI Simulator, a copy of the run documentation is free for the asking.

Write to: Gunn Enterprises, Inc.
P.O. Box 27474
Houston, TX 77027

Putting Your Data Files In Order

Continued from Front Page

nized but the effect is definitely nagging your data clerk (or you). If you entered the information in perfect order then made no corrections/deletions/additions then this wouldn't apply (why are you using a computer if you are so organized?). But if you are using the computer (in a normal fashion) to take a disorderly set of information and sort it for your special requirements, then this technique will apply. It deals with the physical disarray on the floppy disk that results from multiple input sessions normally used to build a data base. During the data input phase, the DBMS program normally attaches each new record at the end of the data file. All of the sort power that you use during report output phase is accomplished with a separate sort file (.SRT) that contains the pointers to the actual data record locations.

The purpose of this discussion is not one of sorts or pointers, but how to reduce disk drive head movement. If the first data record is in the first position and second record is in the last position, then the drive head must travel back and forth as the sort pointer dictates. These extra head movements represent time, each one only a small amount, but on large files they may become numerous. If these large file "delays" become excessive and noticeable then reducing those "extra" head movements may be meaningful. The most effective way to reduce the head movements is to put the actual data records in the order of the desired sort which allows the head to move sequentially through the file. One of my data files had grown to almost 2000 records (at least 10 different input periods). This led to numerous extra head movements during data record updates or on data file outputs. The desired solution was obvious — put the actual data file (.DAT extension) in both good physical and logical order for the sort (.SRT extension) most often used.

The actual solution turned out to be easy to implement with the DBR program. This technique is similar to the procedure in the DBR manual (paragraph 6.7 — Altering a Data Base) describing how to expand/reduce an existing data file. The main difference is THAT YOU ARE MAKING NO CHANGES TO THE FILE SIZE. You simply are using DBR program to read the files in with qualifiers if desired (figure 2) — then write them out in your desired sort to a new file. The sort statement in the DBR program can be as complex as your needs dictate (see figure 3). Remember, you are not making any change in record length. That is important, do not change the record length unless you are also expanding /reducing the data file.

```
------------------------------------------

INPUT
     DATA FILE      "FILENAME.DAT"    (source file name)
     FILE TYPE      DATA BASE
     FIELD          ALL
     TYPE           ALPHABETIC
     LENGTH         200               (actual length of YOUR file)
END

OUTPUT                                (output file name MUST BE DIFFERENT)
     FILE           "NEWFILE.DAT"     (destination file name)
     FILE TYPE      DATA BASE
     RECORD LENGTH  200               (***** SAME AS INPUT LENGTH *****)
END

FIND     EVERY RECORD    END          (no restrictions on input records)

SORT BY ALL(1,30)        END          (use your desired record sort positions)

FORMAT
     ON EVERY RECORD
          PRINT ALL
END

BYE
```

Figure 1 - Typical Data File Sort Program

```
------------------------------------------

FIND     ALL(5,10)<>"CLOSED"  END     (eliminate records = "CLOSED")
```

Figure 2 - Record deletion example

```
------------------------------------------

SORT BY ALL(80,82),ALL(1,10)    END   (use your desired record sort positions)
```

Figure 3 - Sort data file example

```
------------------------------------------

     A.TYPE YOURFILE.MST
          16   1   200
               NAME (LAST,FIRST)          A30
               ADDRESS (LINE ONE)         A25
                       (LINE TWO)         A20
               CITY                       A18
               STATE                      A2
               ZIP CODE                   N9
               MEMBERSHIP (LAST YEAR)     N6
               WAIVES PRIVACY ACT         A1
               USER GROUP                 A14
               PHONE - HOME               N12
                     - BUSINESS           N8
               EQUIPMENT - MAINFRAME      A10
                         - TERMINAL       A10
                         - PRINTER        A10
                         - PHONE MODEM    A10
               COMMENTS                   A15
               1
               DMA.DAT
               DMA-NAME.SRT

------------------------------------------
```

Figure 4 - DBMS MASTER FILE SAMPLE

Continued Next Page

Before you start, be sure to practice good programming habits by making a backup copy of your data files. The technique is relatively simple, but does change the file arrangement. The most likely problem is determining the correct record length to use. The easiest method is to look at the master file (.MST extension) for your data file. This can be done by using the TYPE intrinsic command (i.e., TYPE YOURFILE .MST). The third number (see figure 4) is the record length which is 200 in this example. This is also available at the beginning of the data file. Do not panic on the format of your master file. I added carriage returns and lined up the columns for this article. The actual CRT display is one continuous line until forced to "fold" by the CRT end of line. If you are adding up the DBMS field lengths, then that is the same as the DBR record length and can be put in the INPUT and OUTPUT length statements of your DATA FILE SORT program.

The following explains the procedure that will organize your data file(s) using the data base reporter (DBR) program.

1. Build a DBR program for your particular file (see figure 1). Use normal DBR procedures to create a .SAV file.

2. Run that DBR program to re-sort that data file.

3. Make the original data file a backup (or delete it)

R E N
FILENAME.BAK = FILENAME.DAT

4. Rename the newly built data file to the original data file name.

R E N
FILENAME.DAT = NEWFILE.DAT

5. (Re) Create (function 4) all sort files (using DBMS).

You now have a new data file that is both in good physical and logical order. This will reduce the number of "extra" head movements (time) while seeking the proper record. Once done, a data file tends to remain stable for a period of time and repeats of this procedure would depend on your local workload. This technique can be used as often as needed (daily, weekly, yearly) and would apply whether you built your data file from multiple input sessions or correction / deletion / expansion of an old file.

Not only can this put the data file in order, but if you use a qualifying "FIND" record (figure 2), it might also reduce the file size. I had just recently needed to delete about 1600 records in that same data file. To do this under the DBMS program would have been a frustrating effort with thousands of keystrokes required. However, this was a simple one time effort by using this technique with a "FIND" statement that qualified the desired records, allowing all deletions to be accomplished in one pass. This really worked better for me, in that I had the original file left (under a different name) and a new reduced file of essential records.

Continued on Page 66

```
INPUT
        DATA FILE       "FILENAME.DAT"      (source file name)
        FILE TYPE       DATA BASE
        FIELD           ALL
        TYPE            ALPHABETIC
        LENGTH          200                 (actual length of YOUR file)
END
OUTPUT
        FILE            "NEWFILE.DAT"       (output file name MUST BE DIFFERENT)
        FILE TYPE       DATA BASE
        RECORD LENGTH   200                 (***** SAME AS INPUT LENGTH *****)
END
FIND    EVERY RECORD    END                 (no restrictions on input records)
SORT BY ALL[1,30]       END                 (use your desired record sort positions)
FORMAT
        ON EVERY RECORD
                PRINT ALL
END
BYE
```

Figure 1 — Typical Data File Sort Program

```
FIND    ALL[5,10]<>"CLOSED"     END     (eliminate records = "CLOSED")
```

Figure 2 — Record deletion example

```
SORT BY ALL[80,82],ALL[1,10]    END     (use your desired record sort positions)
```

Figure 3 — Sort data file example

```
A.TYPE YOURFILE.MST
    16    1    200
          NAME (LAST,FIRST)                 A30
          ADDRESS (LINE ONE)                A25
                  (LINE TWO)                A20
          CITY                              A18
          STATE                             A2
          ZIP CODE                          N9
          MEMBERSHIP (LAST YEAR)            N6
          WAIVES PRIVACY ACT                A1
          USER GROUP                        A14
          PHONE — HOME                      N12
                — BUSINESS                  N8
          EQUIPMENT — MAINFRAME             A10
                    — TERMINAL              A10
                    — PRINTER               A10
                    — PHONE MODEM           A10
          COMMENTS                          A15
          1
          DMA.DAT
          DMA-NAME.SRT
```

Figure 4 — DBMS MASTER FILE SAMPLE

bits & bytes, nibbles & tweaks

Arizonans Form Local Group

Cromemco users from all over Arizona gathered at the Phoenix Country Club on May 11th for the inaugural meeting of a statewide users' group — as yet unnamed. The meeting was hosted by Dan Lepinski, president of Professional Data Systems, a Cromemco dealer with sales and service in Phoenix and Tucson. Lepinski made it clear that once the club was formed, his influence would drop to zero, although he would continue to make whatever facilities and information he could available to the members. Many of the staff of Professional Data Services also volunteered to assist the group in its formation and continued activities. Users in Arizona interested in affiliating can contact PDS at (602) 265-6656, or Mrs. Joann Drake at (602) 993-9589.

More Statistics Software Emerging

Since our request for information on statistics packages, we have received a sample from Dr. David Kissinger of Loma Linda University in California, and a description of ABSTAT, a commercial package produced by Anderson-Bell of Denver, Colorado. The former is being tested now, and we hope to have a review by next issue.

SYBEX Sends More Books

One of our original members if Rodnay Zaks, the prolific author of many computer books and founder of SYBEX, Inc., the Berkeley, California publishing company. And one of the things he has done since our inception is put us on the mailing list for new releases from SYBEX. Some of the latest titles received are: **BASIC PROGRAMS For Scientists And Engineers, FROM CHIPS TO SYSTEMS, Introduction to WORD PROCESSING, Introduction to WordStar,** and **Executive Planning with BASIC.** Our reference library continues to grow. Thank you, Rodnay Zaks.

Some Data From Our Survey

The responses have been pouring in — thank you. We are reading each comment and making lists of those which appear more than once. As soon as everything is compiled, we will share the comments in depth. Meanwhile, a few items that have shown up often should be mentioned here.

First, many people would like us to institute a "Software Swapping" service. We will. At this point, we do not know what form it will take or how it will work. We welcome your suggestions.

Second and third items deal with software, to wit CROMIX and 32K Structured BASIC. Many of you want to see regular departments on these subjects. The way to get these started is to send us those tips you have gleaned from your own experience. We will gladly devote the space if you have the tidbits to share.

As stated, more of the survey information will be forthcoming, but we felt these items deserved early mention.

4PIO Boards Revised

As a result of field experiences utilizing 4PIO boards in scientific applications (pollution-monitoring devices), some design faults were isolated. As a result, Cromemco applied a fix to all its inventoried 4PIO cards, and is modifying all new cards. The member who discovered the faults is J. Owen Maloy, Ph.D., president of Mountain Instruments Corporation of Irvine, California. Dr. Maloy worked out his own solutions for field repairs and has graciously made his design notes available to IACU members. Merely write us and ask for "4PIO Fox" and we will forward a copy of Dr. Maloy's Design Note without charge.

FORTRAN Programmer Wanted

The San Francisco Grocery Express is looking for a part-time programmer for maintaining and augmenting their programs. Must be familiar with both FORTRAN and CROMIX. Contact John Coghlan, 1650 Evans, San Francisco, CA 94124. Telephone: (415) 641-5460.

About Local User Groups

A surprising number of survey responses indicated that a regular listing of all local user groups, along with contact phone numbers and addresses, would be most welcome. Okay. We designed a form for such information and sent it to all local user groups of which we are presently aware. As they respond, we will set up a listing for future issues.

Latest Software Inquiries

More members are looking for more specialized packages. The latest requests are for pharmaceutical software (for pharmacists, not manufacturers), a veterinarian package with patient scheduling and interactive with a general ledger, banking and savings and loan packages, and a professional services time and costs billing package. Please contact IACU if you experience with any of them.

Australian Educational Group

A note from Alastair J. Davison brought a new users' group to our attention. The Cromemco Educational Users' Group is composed of 16 schools throughout Victoria (Australia) who meet approximately 6-8 times during the school year to discuss software and educational programs utilizing Cromemco systems. For more information contact Mr. Davison at 103 Pound Road, Warrandyte, Victoria, 3113 Australia.

The Development of a New Family of Computer Products

by David Mandelkern

Continuing its long history of technological leadership, Cromemco just announced a new family of dual-processor computer products. These products incorporate the latest 32-bit microprocessor technology, state-of-the-art error correcting memory, and an advanced operating system and system software. The story behind the development of these products is an interesting one.

It was over three years ago that Dr. Roger Melen, co-founder of Cromemco and Vice President of Research and Development, realized that advances in high-speed metal-oxide-silicon (HMOS) integrated circuits together with advances in very large scale integration (VLSI) would lead to microprocessor chips with significantly more capability than the Z-80A then used as the central processor in all Cromemco computer systems. In order to continue to be able to provide Cromemco users with state-of-the-art computer systems, it was clear that a development effort would need to be begun with one of the emerging high-performance HMOS microprocessors.

Because of its prominent position in the computer industry, Cromemco had access to advance information from Intel, Zilog, Motorola, Texas Instruments, and other manufacturers as to their future microprocessor product plans. After a thorough review of all available information, the decision was made to go with the processor having the most advanced internal architecture (similar to that of mainframes), the largest internal data path width (32-bits), and the largest address space (16 megabytes). The processor was the Motorola 68000.

The 68000

The 68000 is a VLSI microprocessor made possible by a number of advances in semiconductor technology such as dry plasma etching, projection printing, and high density short channel MOS circuit design techniques. By exploiting advanced technology to the fullest, maximum performance and flexibility were designed into the 68000. Some of the advanced features of the 68000, which set it apart from its competitors, include thirty-two-bit-wide data and address registers, a sixteen-megabyte direct physical addressing range, fifty-six main instruction types, five main data types, and fourteen addressing modes (which combine to create over 1000 different instructions). The MC68000 uses internal microcode instead of random logic to implement processing functions, thus allowing easy expansion of the instruction set. The processor architecture was also designed in order to make programming as easy as possible, reducing the time and costs of developing software.

The internal architecture of the 68000 is organized around a thirty-two-bit-wide data path, a feature that neither the Z8000 nor the 8086 (with their sixteen bit internal architectures) can match. Thirty-two bit wide registers give the 68000 number-crunching ability equal to that of the latest supermini-computers. Figure 1 shows the arrangement of the seventeen registers in the 68000.

These registers are used as data registers for byte (8-bit), word (16-bit), and long-word (32-bit) data operations, as address registers for word or long-word operations or for software stack pointers, and as the User and Supervisory Stack Pointer. In addition, there is a thirty-two-bit-wide Program Counter and a sixteen-bit-wide System and User Status Register.

Continued next page

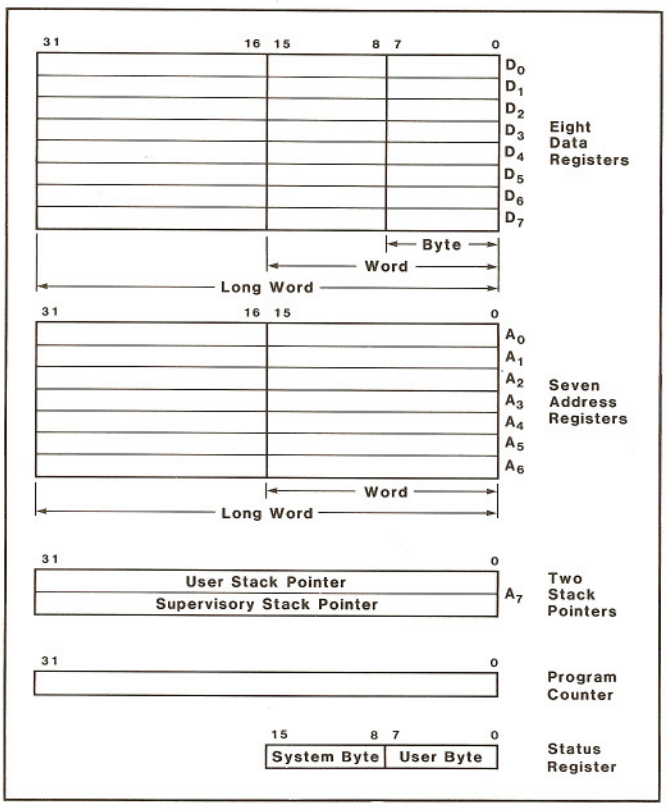


FIGURE 1
Motorola MC68000
Internal Registers

Development of a New Family of Computer Products

Continued from page 15

The twenty-four bit address bus of the MC68000 allows direct addressing of sixteen megabytes. By comparison, the Z8000 and the 8086, with their sixteen bit address buses, are limited to sixty-four kilobytes of direct addressing. This allows the 68000 to offer superior performance in handling large programs without resorting to software memory-management techniques which slow program execution time.

Independent benchmark tests have confirmed that the Motorola MC68000 is significantly faster than either the Intel 8086, the Zilog Z8000, the DEC LSI/11, or the TI TMS9980. The 68000 was two to three times faster in numeric benchmarks such as Sort, Square Root, and Sign Lookup algorithms. In a sample digital filtering application, the 68000 was two-to-three times faster than either the Z8000, the 8086, or the TMS9900. Table I shows the composite results of benchmark tests run on the DEC, Intel, Zilog, and Motorola processors.

The MC68000 is not only significantly faster in execution, but its instruction set requires fewer lines per average program and allows more compact memory storage of programs.

Once the processor was chosen, the system architecture began to fall into place. The processor board would significantly advance the state-of-the-art in microcomputer performance. A small, low-cost desktop package would offer a spectacular price-to-performance ratio with features that were previously unheard of in any but the latest supermini-computers. The new processor would offer thirty-two-bit-wide Data and Address registers, sixteen-megabyte direct addressing range, and an 8 Mhz. clock frequency. The processor would be compatible with the industry standard IEEE-696 or S-100 bus to ensure compatibility with existing hardware and peripherals. However, a special solution was needed in order to provide upward compatibility with existing eight-bit microprocessor software.

Maintaining Compatibility

The existing Cromemco product line was based on the best and most widely used of the eight bit microprocessors: the Zilog Z-80A. Upward compatibility had to be maintained for Z-80 programs. It is expected that history will reveal that the Z-80 is currently in its product infancy. Cromemco expects the Z-80 to continue for many years as the nucleus of the low-cost automated office work-station. Thus, any larger microcomputer would be enhanced by an ability to run the software of the smaller microsystems.

A translation program could have been written that would run on the 68000, but this would make running eight-bit software a slow and cumbersome process. Instead, a novel solution was found to the problem of running Z-80 programs on the 68000 processor board: a Z-80A processor was designed onto the 68000 processor board—hence the name Dual Processor Unit (DPU). A Z-80A was provided as the stepping stone between older 8-bit software and the power of the new 32-bit Motorola MC68000. The new system is shown in Figure 2.

Continued on Page 56

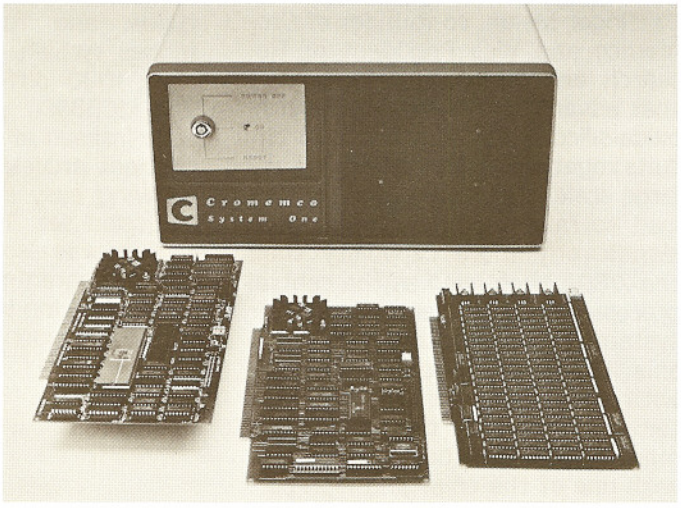


FIGURE 2
The Cromemco DPU Family and System 1 computer

1. Averaged Benchmarks

	Z8002/68000	8086-1/68000	LSI11/68000
TIME	1.71	2.16	5.08
BYTES	1.20	1.57	1.75
LINES	1.23	2.17	1.68

Number shown is ratio of other processor's performance to MC68000 performance

2. Digital Filtering Application
V.P. Nelson & H.T. Nagle, Jr.
Auburn University

Time Lag from Input to Output, in Microseconds:

MC68000	82.25
Z8000	156.25
8086	212.8
TMS9900	253.9

3. Blacksburg Group Inc. Benchmark,
from 16-Bit Microprocessor Handbook

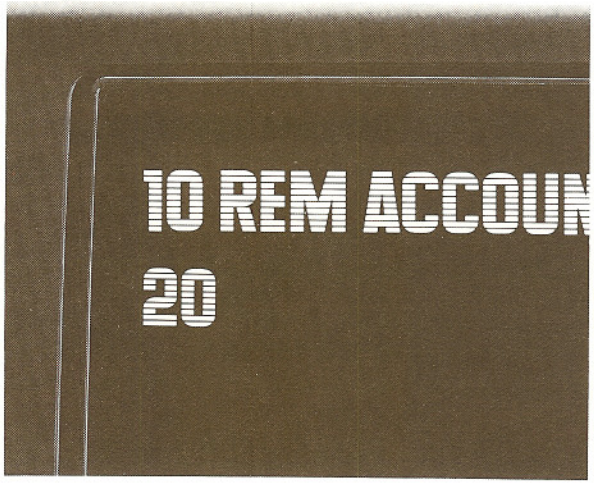
Processor	Initialization (mS)	Sort (Sec.)	String Search (uS)	Square Root (uS)
8086 (5 MHz)	4.683	6.854	375	312/236
Z8002 (4 MHz)*	3.450	4.757	225	134/187
LSI/11	#	10.500	979	457/628
TMS9980 (2 MHz)	#	33.000	2250	680/860
MC68000 (8 MHz)	1.581	2.016	424	88/121

* All times are calculated

Initialization time part of Sort time

TABLE I
Benchmark Test Summary

BOY, IS THIS COSTING YOU.



It's really quite basic: time is money.

And BASIC takes a lot more time and costs a lot more money than it should every time you write a new business software package.

Especially when you could speed things up with dBASE II.

dBASE II is a complete applications development package.

Users tell us they've cut the amount of code they write by up to 80% with dBASE II.

Because dBASE II is the high performance relational database management system for micros.

Database and file handling operations are done automatically, so you don't get involved with sets, lists, pointers, or even opening and closing of files.

Instead, you write your code in concepts.

And solve your customers' problems faster and for a lot less than with BASIC (or FORTRAN, COBOL or PL/I).

dBASE II uses English-like commands.

dBASE II uses a structured language to put you in full control of your data handling operations.

It has screen handling facilities for setting up input and output forms.

It has a built-in query facility, including multi-key and sub-field searches, so you can DISPLAY some or all of the data for any conditions you want to apply.

You can UPDATE, MODIFY and REPLACE entire databases or individual characters.

CREATE new databases in minutes, or JOIN databases that already exist.

APPEND new data almost instantly, whether the file has 10 records or tens of thousands.

SORT the data on as many keys as you want. Or INDEX it instead, then FIND whatever you're looking for in seconds, even using floppies.

Organize months worth of data in minutes with the built-in REPORT. Or control every row and column on your CRT and your printer, to format input and output exactly the way you want it.

You can do automatic calculations on fields, records and entire databases with a few keystrokes, with accuracy to 10 places.

Change your data or your entire database structure without re-entering all your data.

And after you're finished, you can protect all that elegant code with our run-time compiler.

Expand your clientbase with dBASE II.

With dBASE II, you'll write programs a lot faster and a lot more efficiently. You'll be able to write more programs for more clients. Even take on the smaller jobs that were out of the economic question before. Those nice little foot-in-the-database assignments that grow into bigger and better bottom lines.

Your competitors know of this offer.

The price of dBASE II is $700 but you can try it free for 30 days.

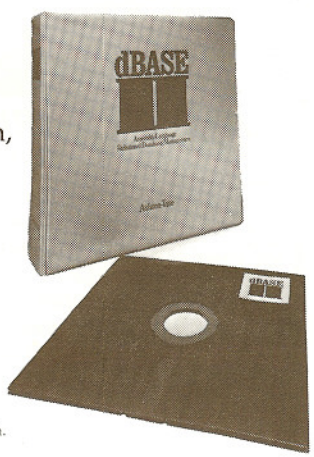
Call for our Dealer Plan and OEM run-time package prices, then take us up on our money-back guarantee. Send us your check and we'll send you a copy of dBASE II that you can exercise on your CP/M® system any way you want for 30 days.

Then send dBASE II back and we'll return all of your money, no questions asked.

During that 30 days, you can find out exactly how much dBASE II can save you, and how much more it lets you do.

But it's only fair to warn you: business programmers don't go back to BASIC's.

Ashton-Tate, 9929 Jefferson, Culver City, CA 90230. (213) 204-5570.



Ashton-Tate

®CP/M is a registered trademark of Digital Research.

Current Versions of Cromemco Software

Package	Version	Date Master Created
Accounts Payable	02.65	01/11/82
Accounts Receivable	02.65	01/11/82
'C' Compiler	05.00	03/11/81
Cromemco Diagnostic System	00.09	12/09/81
Overlay Linker	01.16	11/12/81
CROMIX	11.09	05/24/82
DBMS/DBR	03.05	01/08/81
Dazzler Graphics	00.09	07/07/80
CDOS	02.52	05/17/82
Macro Assembler	03.08	01/27/82
16K Extended BASIC	05.70	04/27/81
COBOL Compiler	04.01	12/01/80
FORTRAN IV	03.42	09/15/81
RATFOR	01.05	09/15/81
General Ledger System	02.65	01/11/82
IOP Development System	02.01	11/19/81
Inventory System	02.65	01/11/82
KSAM	01.00	01/25/82
LISP	01.07	08/15/80
RBTE	01.06	11/13/81
Super Dazzler Graphics	01.08	07/10/80
SlideMaster	02.03	11/16/81
SpellMaster	01.05	10/26/81
32K Structured BASIC	03.65	04/24/81
Word Processing System	06.00	01/08/81
WriteMaster	00.46	01/14/82

Commercial Members Listing

North America
Western United States

ACCOUNTABILITY SYSTEMS
3516 E. Chapman Avenue
Orange, CA 92669
(714) 532-3200

An exclusive Cromemco dealership, Accountability Systems caters to the growing business and industrial base in Orange County. The store carries a full complement of Cromemco hardware and software, and specializes in excellent and prompt service. Developers of a medical billing package that can be used in small to large offices. The package provides full accounting and billing capabilities including: GL, A/R, A/P, Inventory, producing Patient Billings, Medicare & Medi-Cal Billings and Monthly Statements.

Key Personnel: Michael L. Peterson, Systems Analyst
Kathleen Peterson, Office Mgr.
Bruce Hughes, CPA, Acctg. Consultant

Major Market Area: Sales & Service: Orange County
Extended Market Area: Sales & Service: Southern California. Software: Nationwide

APPLIED RESEARCH, INC.
6151 W. Century Blvd., Suite #216
Los Angeles, CA 90045
(213) 670-0811

Complete line of Cromemco hardware, plus Tally Printers. Large inventory of Cromemco software on hand at all times. Other applications software in inventory, plus in-house custom programming. Engineering services and complete consulting available.

Key Personnel: Hal Bradley, President
Dave Van Couvering, Mgr., D.P.
Norman Vadnais, Director Cromemco Sales
John Patterson, Tech. Staff, Sales

Primary Market Area: Los Angeles Basin
Extended Market Area: Throughout Southern California

AMERICAN COMPUTER COMMUNICATIONS, INC.
433 Airborne Blvd., Suite 310
Burlingame, CA 94010
(415) 348-1956

A full-service Cromemco dealership specializing in before or after-sale training — either individual or in classes, ACC offers expertise in configuring CROMIX, Color Graphics, and Plotter Interfaced Systems. Carries Lear Data Software (Tri-Star, Tri-Med, Tri-Dent), dBASE II, WordStar, Spellbinder, FMS-80, - all for Cromemco Systems.

Key Personnel: Taki Oshima, President
John Gibb, Acct. Exec./Graphics
Allaire Turner, System Specialist

Primary Market Area: S.F. Bay Area/Sacramento/Reno
Extended Market Area: Hawaii (Sales, Service & Training)

Special Memberships are open to authorized Dealers and OEMs only. These memberships cost $350 per year, and entitle the member to a special listing on the Association's Referral Service Data Base, as well as this printed listing.

AMERICAN COMPUTERS & ENGINEERS, INC.
Corporate office: 2001 Barrington Ave., Suite 204
Los Angeles, CA 90025
(213) 477-6751/telex: 210-342-6365
Key Personnel: Ghassan Dib, Ph.D., Pres. (Struc. Eng.)
Aziz Al-Khal, Sales & Marketing (Indus. Eng.)

Newport Beach, CA: 4141 MacArthur Blvd., Suite 216; 92660
(714) 851-8700
Key Personnel: Marwan M. Dib (M.S. Mech. Eng.)

Berkeley, CA: 2855 Telegraph Ave., Suite 508; 94705
(415) 849-0177
Key Personnel: Kathy Kolder, Sales & Marketing
John Klaren, Sales & Cust. Support

Paris, France: 55 rue de rivoli; 75001
236-9495
Key Personnel: Maurice Gaspard, Ph.D.
Gabriel Gaspard, Ph.D.

Tripoli, Lebanon: Socomet/Bahsas, P.O. Box 214
628-3000
Key Personnel: Moussa Dib, Executive V.P. (Const. Eng.)

Canada: Deerfoot Business Centre, Suite 230, 6715 8th St. NE; Calgary, Alb. T2E 7H7
(403) 275-5871
Key Personnel: John Caron, M.Sc.
Mylo Stromsoe, C.A.
David Lavers, P. Eng.

Consulting engineers; sales & service. On-site or in-house service agreements to the end user. Specializing in structural engineering programs; accounting; word processing. Newport Beach facility is equipped to perform repairs on all Cromemco products. Fast turn-around.

Major Markets: Structural/Petroleum/Industrial engineering; accounting and word processing for the Canadian market.

GLOBAL TECHNOLOGY, INC.
28509 Seamount Drive
Palos Verdes, CA 90274
(213) 325-7037/Telex: 910-696191

California-based import/export corporation specializing in promoting trade of technology, systems, equipment, components and materials for scientific and industrial applications between U.S. manufacturers and the Orient —particularly the People's Republic of China.

Key Personnel: Dr. Lily Wang
Mr. Chung Wang
Ms. Y. Lee

Major Market Area: The People's Republic of China

Continued next page

INFORMATION MANAGEMENT INTERNATIONAL (IMI)

Corporate Office: **1101 S. Winchester Blvd.**
San Jose, CA 95128
(408) 248-8250

Los Angeles Area Office: **23450 Calabasas Road**
Woodland Hills, CA 91364
(213) 347-3251

Largest overseas distributor of Cromemco products, providing OEMs and systems integrators with hardware and software. Consultants in banking/financial systems, robotics, graphics, medical systems, and communications.

Key Personnel: Bob Blaisdell, Managing Director
Joy Stone, Sales Coordinator
Chris Glon, Technical Advisor
Don Walker, Technical Advisor
Dave Schilling, Medical Systems

Major Market Areas: California, France, Asia. (both sales and service)

LEAR DATA CORPORATION
2401 California Blvd.
Napa, CA 94558
(707) 252-7139

Systems House and full Cromemco dealership in professional, 3,000 square foot office facilities. Separate lab and repair facilities. 24-hour service responses. Provides full warranty service. Drive alignments done in-house. Developers of the Tri-Star, Tri-Dent, and Tri-Med software systems.

Key Personnel: Robert Gustafson, Pres.
Dr. Joseph Nelson, Vice Pres.
Arnold Gold, Mktg. Director
David Bryan, Sr. Systems Analyst

Major Market Area: Software — Nationwide
Hardware — Northern California

MCM ENTERPRISES
459 Hamilton Ave., No. 304
Palo Alto, CA 94304
(415) 493-3333

A full service computer solutions company with consulting, equipment, software, training, and service. MCM carries a full line of Cromemco Systems, Lear Tristar and Serendipity Business Software, and NEC Service Center for Northern California (printers and printing terminals).

Key Personnel: M.C. Merchant, (MSEE) Owner
C. Leighton, Project Manager
G. Nielsen, Service Engineer
S. Evans, (CPA) Bus. Consultant
J. Peckler, (CPA) Bus. Consultant
L. Terry, Acctg. Sys. Consultant
L. Yori, (BSEE) Mgr. Reno Office
M. Nadaire, (MSEE) Mgr. Paris Office

Major Market Area:
Sales: San Francisco Peninsula & Nevada extending internationally.
Service: S.F. Peninsula & Nevada extending into N. California

Reno Office: 1275 Kleppe Lane, No. 14
Sparks, NV 89431
(702) 358-0415

Paris Office: 4 Rue Paul Bert
92150 Suresnes, France
Tel (1) 506 33 03 TLX 610994F

UCI/THE SYSTEMS STORES

ARIZONA
4022 E. Broadway, Suite 112
Phoenix 85040
(602) 255-0700

CALIFORNIA (Home Office)
2520 Mission College Blvd.
Santa Clara 95050
(408) 988-1988

NEW MEXICO
6104 Kircher Blvd., N.E.
Albuquerque 87109
(505) 345-9981

OREGON
5687 S.E. International Way, Ste. 1
Milwaukie 97222
(503) 653-5940

WASHINGTON
14102 N.E. 21st Street
Bellevue 98007
(206) 643-7444

UCI/The Systems Stores are full service distributors of Cromemco Systems and peripheral equipment for Business, Science & Industry.

Managers: Albuquerque — Paul Enz
Bellevue — Doug Pomeroy
Milwaukie — Mary Loring
Phoenix — Sam Kershaw
Santa Clara — Douglas Sherrod

Mid United States

COMPUTER CENTERS OF AMERICA

2129 Westheimer Road
Houston, TX 77098
(713) 527-8008

2629 Stemmons Fw., 215
Dallas, TX 75207
(214) 638-4477

Complete line of hardware and software. Repair on warranty service. Distribution and OEM division. In-house software house with products in system and applications software. Special export department to service foreign dealers.

Key Personnel: Avery More, President (Sales)
Lee Dixon, Dallas Manager
Race Feirman, Houston Manager
Moti Tenenhouse, Technical Director

Major Market Area: Texas, Southwest, Mexico, Middle East

JEPSAN GROUP K, INCORPORATED
4180 44th Street, S.E.
Grand Rapids, MI 49508
(616) 698-8700

Jepsan Group K is an exclusive Cromemco dealer located in a professional office environment with two demo rooms and four Cromemco Systems for use by customers. Extensive service facilities for all Cromemco hardware, including expertise in PerSci drive and IMI disk repairs. Software consultation and customizing, with specialties in accounting and business applications. Developers of *File Management.*

Continued on next page

Key Personnel: Phil Schneider, Pres.
John Nordine, Vice Pres.
Ellen Light, Sales Coordinator
Brian Nielson, Service Mgr.

Major Market Area: Sales and Service: Western Michigan
Extended Market Area: Service and Software: U.S. and Canada

TRADEWIND SYSTEMS
Box 96
Liberal, KS 67901
(316) 624-8111, O/S KS 1-800-835-2057

Exclusive Cromemco dealer, specializing in complete business systems. Provides consulting services. Full inventory.

Key Personnel: Clark Stewart, Pres. (business systems)
Wayne Stewart, Vice Pres. (tech./software)
Kevin Elmore, Programmer/analysis

Major Market Area: Sales: S.W. Kansas, extending to Colorado, Kansas, Oklahoma, Texas, New Mexico.
Service: S.W. Kansas

SYNERGISTICS INTERNATIONAL LTD.
35 Fountain Square Plaza, Box 631
Elgin, IL 60120
(312) 695-7775

Full inventory of Cromemco hardware and software. Custom software developed in-house. Vertical market packages available include: Chiropractic Clinics; Architectural Woodwork Job Costing; Social Service Agency Accounting; Auctioneering. Specializing in providing turnkey systems to small and medium sized businesses.

Key Personnel: Jim Knowles, Pres. (Sales)
Gordon Muirhead, Vice Pres. (Software)

Major Market Area: Sales: Chicago and suburbs, extending to entire U.S. and the U.K. Service: Chicago and suburbs.

Eastern United States

COLLINGSWOOD COMPUTER CENTER
1165 Barbara Drive
Cherry Hill, NJ 08003
(609) 488-1144

Medium-sized software house, specializing in small business systems; all models of Cromemco/payroll, billing, mass mailer. Provides warranty service also contract and hourly service.

Key Personnel: Jim Lenz, Pres. (Software design & development)
Deborah Lenz, Vice Pres.
Ken Peacock, Service Mgr.

Major Market Area:
Sales: New York to Washington, extending to entire U.S.
Service: Metro Philadelphia extending to Eastern Corridor.

COMPUTER SYSTEM & TECHNOLOGY, INC.
21-55 44th Road
Long Island City, NY 11101
(212) 937-2900/Telex: 910-429418 CSTNY

Involved in computer business since 1979. Key personnel have strong background in engineering, software development, financial markets and import/export trade. Provides consultation and custom-made programs for governments, manufacturers, wholesalers, retailers and professionals.

Key Personnel: Mr. Mike Fung, Vice President
Ms. Fanny Ho, Manager
Ms. Salina Ho, Systems Analyst

Major Market Area: New York, China, Hong Kong and Iceland

COMPUTER SYSTEMS FOR SMALL BUSINESS
42 West Ivy Lane
Englewood, NJ 07631
(201) 568-7602

CSSB is a small service bureau and software house using Cromemco hardware combined with proprietary custom software. Software applications packages include PAYROLL, ACCOUNTS RECEIVABLE, SALES ORDER ENTRY WITH INTEGRATED INVENTORY, GENERAL LEDGER, and MAILING LISTS. Packages are expandable, but current average user has 200 active employees, 1500 customer accounts, 6000 open invoices, & 7500-part inventories. CSSB installs and maintains Cromemco systems as an OEM. Other services include custom business programming, consulting, and on-site training.

Key Personnel: Coley Brown, President

Primary Market Area: Hardware Sales & Service — New Jersey & Southern New York State. Software Licensing & Service — U.S., Canada & Mexico.

CUSTOM COMPUTER SPECIALISTS, INC.
208 Roanoke Avenue
Riverhead, NY 11952
(516) 369-2199

Full service systems house with retail showroom. Full line of Cromemco hardware, software, accessories, and literature. Provides warranty service, diagnostics, consultation, systems analysis, and custom programming. Special management software for attorneys, mass transportation scheduling, reservations, delivery manifests, education, small businesses. School rentals, teacher training.

Key Personnel: Gregory G. Galdi, Pres.

Major Market Area: Sales: Northeast U.S., extending to East Coast
Service: East Coast extending to Continental U.S.

DIGIBYTE SYSTEMS CORP.

31 East 31st Street	**480 Lexington Avenue**
New York, NY 10016	**New York, NY 10017**
(212) 889-8130	**(212) 687-5090**

Complete computer center housing a full line of Cromemco hardware and software. Special services include installation, warranty service, and customer education. Large selection of Cromemco software packages as well as custom programming for business and professional applications.

Key Personnel: Robert Silverman, Pres. (software)
Barry Becker, Vice Pres. (hardware)

Major Market Area: Service — Primarily East Coast.
Sales — Worldwide

Continued on next page

METROPOLITAN COMPUTER
110 Harvard Street
Brookline, MA 02146
(617) 277-5115

A full service and support dealership committed to a full line of Cromemco products. Service offered on both an hourly basis and by contract, and includes custom-designed hardware and software for individual interfacing needs as well as communications applications. Complete Cromemco line on display and available for hands-on demonstration, including color graphics system.

A wide range of software including all Cromemco software is available. Dealership specializes in word processing, accounting packages and data base systems. A full-time engineering and sales staff is maintained for customer support.

Key Personnel: Frederick S. Lebow, President (Engineer)
Dwight Calhoun, Director of Engineering
Melissa Lavers, Sales Staff
Eugene Cimino, Sales Staff
C. Eugene Jones, Sales Staff
Karen Greenberg, Sales Staff

Primary Marketing Area: Massachusetts
Extended Marketing Area: New England States

ROYAL DATA, INC.
2203 Garden Street
Titusville, FL 32780
(305) 267-1960 269-3116

A full-service computer sales and support organization. More than 22 years comprehensive applications experience in process control, telecommunications and office automation. Complete Cromemco line in stock, including Graphics systems.
Featuring manufacturing inventory control, Bill of Materials, Accounting Plus software, Lear Data Tristar dental and general business software. Custom development for real-time data acquisition and control. Emulator support of virtually all CP/M software under CDOS and CROMIX.

Key Personnel: Jency Kelly, Pres. (sales & marketing)
Mark Clough, Sales Engineer
Bill Hardin, Repair and Maintenance
Charles Brossier, II, Technical Software Support
Jean C. Kelly, Office Manager

Major Market Area: Southeast Florida

Mexico

SOPORTE ADMINISTRATIVO COMPUTACIONAL, S.A.
15 De Mayo #1111 PTE
Monterey, N.L. Mexico
43-83-40

Complete line of Cromemco hardware and software in inventory. Specializing in the educational field. Full service facility, providing technical consulting, as well as warranty repair service.

Key Personnel: Juan Angel Perez, Director (systems)
Jaime Martinez, Customer Support (MSEE)
Gerardo Elizondo, Technical Mgr. (MSEE)

Major Market Area:
Sales & Service: Internationally, primarily Mexico

MICROMEX, S.A.
Aldama No. 78
Mexico, D.F. 04100
554.75.75, 554.27.42

Full service company. Complete line of Cromemco equipment with sales agencies in Mexico City, Monterrey, Guadalajara, Tampico, Veracruz, San Luis Potosi, Coatzacoalcos and Torreon. Emphasis on complete computer solutions for small and medium-sized companies. Warranty and regular service available.

Key Personnel: Dr. Enrique Grapa. General Manager
M.C. Angel Kuri, Hardware Director
Ing. Pedro Excarcega, Softare Director
C.P. Louis Antonio Sandoval, Administration Director
Marcos Ortiz, Sales

Major Market Area: Sales & service: Latin America, primarily in Mexico and Central America.

South America

EPROM LTDA.
Antonio Bellet 226, #704
Casilla 16494, Correo 9
Santiago
Chile
740910/Telex: 359-94436 PBVTR KU

Eprom is a consulting firm which specializes in software development for business applications and process control in industries. Computer marketing of the company is limited to CROMEMCO systems.

Key Personnel: Jorge Bellet, Sr. Executive
Eliana Ferrada, Administrator
Friedmut Ballek, Sr. Engineer

Major Market Area: Most of Chile. Local service is now being offered in Santiago, Valparaiso, Concepcion and Africa.

PERSOCOM
Av. Corrientes 447, Piso 7°
1043 Buenos Aires
Argentina
011-541-394-1913/Telex: 390-17341 ITEL-A RMMM

Persocom SA is the holding company of Plus Computers SA. Plus is marketing a full line of CROMEMCO products along with other IBM-compatible products.

Key Personnel: Esteban Gimenez Vives, President, General Manager
Raul Manuel Avila, Director of Operations
Roberto Boldrini, Director of Technical Support

Major Market Area: All of Argentina, with special emphasis in the Buenos Aires area.

Continued next page

International

Great Britain

DATRON MICRO-CENTRE
2 Abbydale Road
Sheffield, England
0742-585490 / Telex: 547-151

Main importer, sales and support to dealers and direct, Europe wide. Full Cromemco range. Standard software & consultancy for special applications. Experienced in customized hardware and device drivers and provides warranty and duration service.

Key Personnel: Ian Dunkley, Director (sales)
Dave Rotherham, Software Specialist
Alan Deeley, Hardware and Configuration
Paul Waring, Civil Engineer

Major Market Area: United Kingdom, Europe

COMART LIMITED
Little End Road
Eaton Socon
St. Neots, Huntingdon
Cambridgeshire PE19 3JG
UNITED KINGDOM
(0480) 215005/Telex: 851-32514 COMART G

Dynamic UK distributor—20,000 sq. ft. warehouse. Full CROMEMCO range of hardware, software, and peripherals for stock, demo and training. Nationwide network of dealers. Sales, plus full hardware and software support. Warranty service, plus maintenance and service repair at nationwide and local levels. Extensive testing and development facilities.

Key Personnel: David Broad, Managing Director
John R. Lamb, Marketing Director
David Fear, Sales Director
Peter Webster, Product Marketing Mgr.

Major Market Area: Nationwide UK and Eire

LENDAC DATA SYSTEMS, LTD.
8 Dawson Street
Dublin 2, Ireland

Suppliers and supporters of the full range of Cromemco Computer Systems and software.

Key Personnel: Don Lehane, Director, BSC (Computer Science)

Major Market Area:
Sales & Service: Throughout Ireland

Europe

AGRO MARKETING
B Adzije 7/1, 41000 Zagreb
Yugoslavia
41 417-662 Telex: 2141yuam

Large full-service facility, with complete line of Cromemco products and proprietary software. Specializing in software development, interfacing, and special medical computerized equipment.

Key Personnel: T. Raguz, Director (Marketing)
N. Ivancic, Software Manager
B. Krtolica, Customer Support (Hardware)

Major Market Area:
Sales & Service: Internationally, primarily Yugoslavia

COMPUTEC BENELUX, B.V.
Prunellalaan 3
P.O. Box 128
5580 AC - Waalre
The Netherlands
31-04904-5865/Telex: 844-59175

Computec Benelux is a "daughter" of The Vollwood Organization, a holding company with working companies in many European countries. Active in selling business-type applications where CROMEMCO hardware, with a wide choice of terminals, is provided to OEM'ers and subdealers. Specializes in hardware maintenance and adaptations in the hard software.

Key Personnel: Mr. H. Oosterveer, Purchasing, Vollwood
Mr. M. Scheller, Germany
Mr. J.W. Rozema, The Netherlands

Major Market Area: Major Market Area: Germany and the Netherlands

C.T.A. COMBITEXT AUTOMATION
Klein Loolaan 23
3972 KB Driebergen
The Netherlands
03438-17777/Telex: 844-40444 dfe nl

A leading company in the Benelux, in the micro computer market. Represents CROMEMCO computers in these countries. CTA specializes in selling to OEM's, large computer users, and self-programming customers. End-users are supplied with application software via CTA software houses.

Key Personnel: P.H.J.M. Haffmans, Managing Director CTA Int'l
N. Van Den Bosch, Managing Director CTA Computers
F. Arnolds, General Manager/Software

Major Market Area: The Netherlands

DIALOG COMPUTER SYSTEME GMBH
Frankfurter Allee 1-3
6236 Eschborn
West Germany
06196-46060/Telex: 841-415601 TELEP D

CROMEMCO distributor for the BRD, with a large full hardware-service capability. Offers software support to the CROMEMCO software packages. Primarily serves system and software houses.

Key Personnel: Mr. M. Scheller, Managing Director
Mr. W. Krainski, Techn. & software sales support
Mr. W. Moos, Service Manager

Major Market Area: Primarily West Germany

UNICOMP SPA
via fratelli gracchi, 48
20092 cinisello balsamo (milano)
(02) 6121041 (5 linee r.a.)

Inventories complete line of Cromemco hardware and software in Italy, with a market extending into Greece. A four-year-old distributor firm, Unicomp offers sales and support of the full Cromemco line for business, scientific and industrial applications.

Key Personnel: P. DiCamillo, Managing Director
S. Focardi, Sales Director
F. Montanari, Systems Manager
A. Capocchi, Service Manager

Major Market Areas: Italy, Greece Continued next page

Mediterranean

COMPUTER APPLICATIONS COMPANY, LTD.
29 Arcadias Street
Athens 608, Greece
779-8868 or 778-7708

The exclusive Cromemco distributor in Greece, Coputer Applications Company, Ltd. specializes in applications relating to the proprietary software it has written for Civil Engineering, Shipping, and Hotel industries.

Key Personnel: Dennis Ioakim
Theocharis Vafiopaulos

Major Market Area: Greece

Africa

REALTIME ENGINEERING & DATA ANALYSIS
P.O. Box 278
Dharan Int'l Airport
Dhanran, Saudi Arabia
(966) (3) 8649043/Telex: 928-670480 READAK SJ

P.O. Box 6156
Jeddah
Saudi Arabia
(966) (2) 6531502

Sales and maintenance of computers, peripherals and supplies within the areas of automation, industrial, business and office. Security systems. Strong in developing Arabic systems (hardware and software) and turnkey projects. Large simulators and facsimile.

Key Personnel: A.A. Salamah, Administrative Director
Nasir Jamil, Manager Digital Systems Div.
Ziyad Ismail, Software Design and Development

Major Market Area: Master CROMEMCO distributor for Middle East (Saudi Arabia, Gulf Emirates, Iraq, Syria, Jordan, Lebanon)

Far East

ASAHI GLASS
Electronics Group
Special Products Marketing Div.
1-2 Marunouchi, 2 Chome
Chiyodaku, Tokyo 100
Japan
Telex: 24616 ASAGLAS

Complete line of Cromemco hardware and software in inventory. 700 sq. foot training room. Specializing in O.S. modifications. Full service facility, providing technical consulting as well as warranty repair service.

Key Personnel: Shigeo Satoh, General Manager (systems)
Norimasa Hori, Manager (sales)
Shinichi Watanabe, Tech/software

Major Market Area: Japan

COMPUTER SHOP
JL. DR. Wahidin No. 11
Jakarta, Indonesia
62-21-355868

Complete computer center housing a full line of CROMEMCO hardware and software. Special services include installation, warranty service, and customer education. Separate lab and repair facilities specializing in software development for Indonesia.

Key Personnel: Renaldi Z.K., Managing Director
Veny Zano, Service Manager
Anton, Software design & development
U.L. Permadi, System design

Major Market Area: Stores in Jakarta, Bandung, Surabaya, and Medan, Indonesia.

INDONESIAN COMPUTER ENTERPRISES
JL. Juanda No. 87
Bandung, Indonesia
62-22-81995/Telex: 28360 AC BD

Complete computer center housing a full line of CROMEMCO hardware and software. Special services include installation, warranty service, and customer education. Separate lab and repair facilities specializing in software development for Indonesia.

Key Personnel: Renaldi Z.K., Managing Director
Veny Zano, Service Manager
Anton, Software design and development
U.L. Permadi, System design

Major Market Area: Stores in Jakarta, Bandung, Surabaya, and Medan, Indonesia.

NCC INTERNATIONAL
Matsunaga Building 1-6-6
Sotokanda Chiyodako
Tokyo, Japan
03-255-1984/Telex: 781-2523758

The oldest Japanese microcomputer store of the Byte Shop chain, offering CROMEMCO to Japan since 1977. This company primarily sells CROMEMCO equipment, and provides high technology and comfortable customer service.

Key Personnel: Kiyoake Ikeda
Toshinori Yamamoto
Ryuichi Kawase

Major Market Area: Japan

REC EMSCO
51-52 Haiphong Road
Kowloon, Hong Kong
3-685211/Telex: 84617 EMSCO HX

Electronics and computer distributors.

Key Personnel: Peter Chan
Raymond Watt
Robert Chiu

Major Market Area: China and Hong Kong

Continued next page

SYMBOL ENTERPRISE CO., LTD.
8th Fl. Formosa Plastic Bldg.
New Wing, 201-18 Tunghwa North Road
Taipei, Taiwan
Republic of China
01-722-2777/Telex: 785-22559 BAYFLOW

Symbol Enterprise and its associate, Bayflex Computer, are CROMEMCO computer distributors. They provide the sale and maintenance of hardware, as well as software programming, data processing, and computer programming in Chinese.

Key Personnel: Hurdy J.W. Su, Executive Vice President
Ju-Jer Yang, Vice President
Shu-Ching Kuo, Senior Programming Engineer

Major Market Area: Major Market Area; Taiwan, Republic of china

TIEN SHENG ENTERPRISE CO., LTD.
30 Hoping West Road, Third Floor
Section 1, P.O. Box 30 518
Taipei, Taiwan
Republic of China
02-392-2284-56/Telex: 785-22842 TIENSHEN

One of the largest importer/exporters of computer business/industrial control systems in Taiwan. With several years of computer engineering experience, Tien Sheng provides turnkey basis and reputable service.

Key Personnel: Mr. R. Sheu
Mr. C.K. Cheng
Mr. M.S. Hu

Major Market Area: Taiwan, Republic of China

Australia

INFORMATIVE SYSTEMS P/L
3 Bank Street
South Melbourne, Victoria, Australia
03-6902284 TWX 30458

Full range of Cromemco, retail and wholesale computer store. Provides full sales and service, specializing in education and small business applications.

Key Personnel: Dr. Simon Rosenbaum, Mng. Dir.
Ian Savicky, Tech Advisor
Norman Rosenbaum, Sales Mgr.
Mark Coulthard, Engineer

Major Market Area: Sales & Service: Throughout Australia

How the DPU Works — A Program Example

by John Bridgman & Michael Betts

The Cromemco Dual Processor Unit (DPU) combines the best of both the 8 Bit and 32 Bit microprocessor worlds on one S-100 board. In addition to the 4 Mhz Zilog Z-80A, the DPU contains an 8 Mhz Motorola 68000.

This combination allows the owners of current Cromemco Z-80 based systems an upgrade path to the power, speed, and vast memory space of the 68000 without sacrificing any compatibility with their current software.

The purpose of this article is to illustrate by example an assembly language program, written in Z-80 assembler, which calls a 68000 multiply subroutine. This program illustrates how the DPU can, by means of software instructions, switch from Z-80 operation to 68000 operation and back again.

The DPU always comes up from power-off or reset in Z-80 mode. To switch to the 68000, all that is required is an output to port 0FFh. The 68000 uses memory mapped I/O, so an output is performed by moving data to the highest page of memory. Therefore the switch back to the Z80 is done by moving a 0 to memory location 80FFh (Port 0FFh).

Naturally when using the DPU with the Cromix Operating System, the details of Z-80/68000 switching are handled automatically and are transparent to the user. But for those of you who enjoy seeing how things work on the machine code level, you'll surely want to try the program listed below.

```
;
;This program prompts for two hex numbers to be input from the
;CRT.  The numbers are converted to binary and placed in memory
;for processing by the 68000 microprocessor on the DPU board.
;The 68000 executes a program that gets the two arguments and
;multiplies them. The 4 byte result is loaded back into memory,
;and control is returned to the Z-80.  The Z-80 then converts
;the 32 bit binary result into 8 hex digits and prints the results
;on the CRT. This example runs under CDOS and uses CDOS calls for
;simplicity, and since it would be unwise to change processors
;yourself in a multi-user environment.
;
arg1:   equ     4000h
arg2:   equ     4100h
stack:  equ     4000h
mcnt:   equ     100d
;
        ext     binh2,ahex,prnbf$,gtln1$        ;asmlib routines
;
start:  ld      hl,6500h        ;setup for 68000 to out 0 to 0FFh.
        xor     a
        ld      (hl),a
        ld      c,9             ;print begin message.
        ld      de,msg
        call    5               ;call CDOS
        ld      c,1             ;do read call to allow for pause.
        call    5               ;call CDOS
        ld      de,6000h        ;load a prog. for the 68000 to run.
        ld      hl,prog68       ;prog68 is the 68000 program
        ld      bc,count
        ldir                    ;move 68000 program to execution area
;
;Input two numbers to be passed to the 68000 for multiplication.
```

Continued on Page 64

A Review of PlanEASe

by Richard Quinn

Some of the most educational experiences I had when I was a student at Pepperdine University's School of Business were the business simulations in which we participated. One in particular was a computer simulation of an appliance manufacturer. We were in competition with five other student teams. Our team did quite well, simply because we were able to get information out of the simulation computer faster than our competition. We knew where we were at any given time in a business cycle. Even though our instructor controlled the "business environment" and tried to make things tough, quick information from the computer kept us on track and helped us make the right decisions in a hurry.

At the time, I thought a real business would have a great competitive advantage is such systems and models were available. It could provide a great competitive advantage. Many firms are developing just such "models" to determine the probable outcome of decisions. With the advent of the computer, modeling that was almost impossible to do in the past is not only now possible, but very easy and fast.

I recently spent some time on just such a model developed and marketed by Analytic Associates. The model, called PlanEASe, was designed to be used with modules that provide different business models so that intelligent decisions can be made with regard to questions of investment, oil drilling ventures, purchase vs. leased equipment arrangements, real estate partnerships and investments, personal financial planning, and long range business planning. The model uses the internal rate of return for purposes of analysis. Analytic Associates' plans are for other modules that will enable managers and investors to play "what if games" in many areas of investment and management.

I was particularly impressed with the scope of factors over which the user of the model has direct control. The module I was using was for rental unit investment analysis. Starting with the extremely simple to use installation program, the system is designed to use a wide range of CRTs and printers with quick checks on all functions as they are installed. This installation program customizes the program to your CRT giving it a truly user friendly and professional look. In addition, Analytic Associates has made clever use of the tab key in data entry. The comprehensive and well-written manual includes necessary data for installation of most CRTs, but if yours is not listed you can supply your own control sequences.

The program comes with a demonstration diskette complete with its 32K Structured BASIC run module. Analytic Associates has an agreement with Cromemco to supply the BASIC run module so if you don't have Structured BASIC, no problem. The run module is covered in the price of the system. The demo disk has a completely interactive demonstration package complete with a demonstration analysis all set to go. You can change assumptions, add depreciation schedules or adjust investor's assumptions and see the results in a flash. The assumptions cannot be saved in the demonstration copy and you are limited to a small number of business cycles and assumption tables, but even with these limitations, you can see the full features of the system. Like what you see? Open the sealed diskettes with your registration number, send in the registration form, and the full featured system is all yours. Otherwise, return the package for a refund.

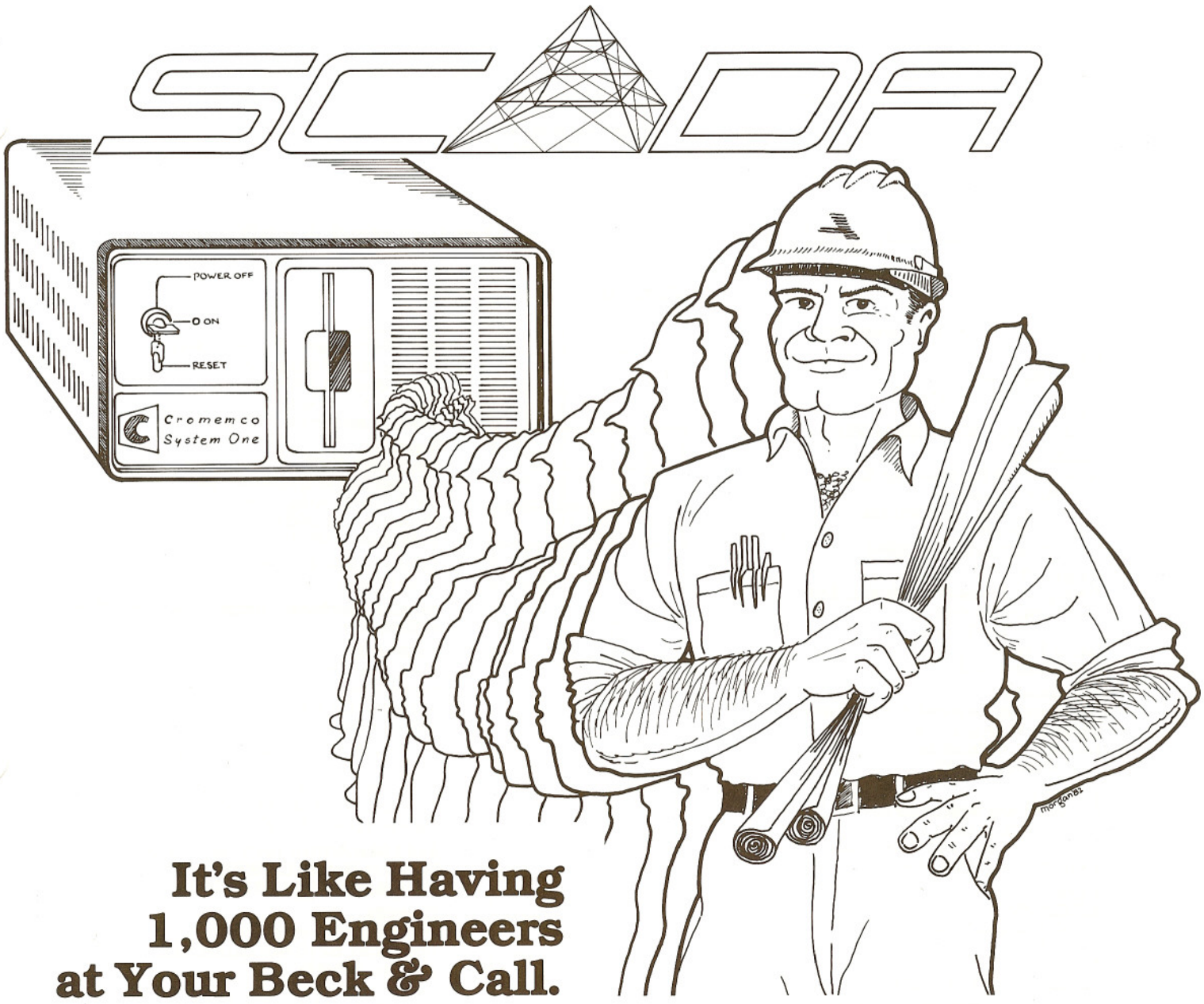
Let me take you on a simple modeling session with the rental unit module.

Say I but an apartment unit with some of my own money and loans from three different lending agencies at different interest rates. I know that inflation will run between nine and twelve percent with the nine percent end being the most likely. I know that certain major repairs will have to be done on the roof, heating systems, carpeting and plumbing within the next five to ten years. I depreciate each of those items at different rates; the carpets quickly, the roofing slowly. (Many accountants have used the system for developing depreciation schedules only, a very powerful feature of the system.) I input the price of the property, closing costs, acquisition cost, holding period, gross income multiplier, selling costs, inflation rate, tax information, desired rate of return and other information. I included depreciation schedules for all items to be depreciated. Then I ran the model to produce the results. The model displayed the information in table and graph form. I was impressed with how easily you can spot the ideal investment conditions and likewise the conditions that make an investment a poor risk.

Want to see how sensitive your investment is to inflation or interest rates on the borrowed money? Want to see if the investment becomes marginal if the rate of inflation or the levels of occupancy change too much? Maybe you just want to know where those bad areas lie. No problem. The system allows for a Monte Carlo style risk analysis taking a range of factors into consideration. More important, it shows you from a cash flow point of view what to expect. I can afford high interest on borrowed money if the rate of inflation will improve my cash flow situation in time to cover expenses, but if the rate of inflation suddenly drops I could be in for real trouble.

On top of that, the model allows me to favor the most likely condi-

Continued on Page 56



It's Like Having 1,000 Engineers at Your Beck & Call.

Engineers whose daily involvement make them experts in 3-D truss elements, 3-D frame elements, 2-D beam elements - even sheer wall elements, plate elements and eight-mode solid elements.

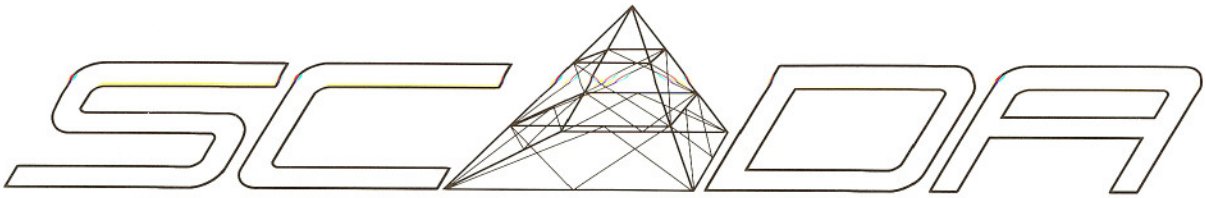
In short, engineers who understand and can design structures. Any structures from little bridges to giant high-rises.

You see, SCADA as a software program is unique. It was written by structural engineers for structural engineers. And, it is supported by structural engineers. There aren't quite 1,000 of us, but with SCADA working for you it often seems like there are.

SCADA is the proud creation of SCADA Systems Corporation and is demonstrated at SCADA Centers worldwide.
Contact American Computers & Engineers for the location of the SCADA Center nearest you.

Los Angeles Headquarters: 2001 So. Barrington
Los Angeles, CA 90025 • (213) 477-6751
Berkeley: 2855 Telegraph Ave.
Berkeley, CA 94705 • (415) 849-0177
Newport Beach: 4141 MacArthur Blvd.
Newport Beach, CA 92660 • (714) 851-8700
Canada: 6715 Eighth St. North East
Calgary, Alberta T2E7H7 • (403) 275-5871
France: 55 Rue de Rivoli • Paris, France
Tel. 236-94-95

AMERICAN COMPUTERS & ENGINEERS



Structural Computer-Aided Design and Analysis

NOW AVAILABLE WORLDWIDE

SCADA Dealers

Chile
EPROM, Ltd.
Casilla 16494, Correo 9
Santiago, Chile
Telephone: 760910-2511605

Australia
Informative Sytems Pty. Ltd.
337 Moray Street
South Melbourne, Victoria
3205 Australia
Telephone: (03) 690 2284

England
George J. Irwin & Partners, Ltd.
29 Brandon Street
Hamilton, ML3 6AB
Great Britain
Telephone: 282062

Indonesia
Indonesian Computer Enterprises
Jalan Ir. H. Juanda 87
Bandung, Indonesia
Telephone: 81995

Norway
Norske Data Systemer AS
Kongensgt. 2, Oslo 1
Hareveien 32A, 1413 Tarnasen
Telephone: (02) 41 08 30

Peru
ENTEL Peru
Av. Venezuela 704-902
Lima 5
Peru
Telephone: 5144 232520

SCADA Centers*

SCADA is demonstrated by engineering professionals in the following locations:

California
Englekirk & Hart,
Consulting Engineers, Inc.
2116 South Arlington Avenue
Los Angeles, CA 90018
Telephone: (213) 385-9696

Colorado
N.V. Tsiouvaras & Associates,
Consulting Engineers
2430 South University Blvd.
Denver, CO 80210
Telephone: (303) 778-6117

Hawaii
Englekirk & Hart,
Consulting Engineers, Inc.
1314 South King Street
Honolulu, HI 96814
Telephone: (808) 524-1037

**More Scada Centers are opening monthly worldwide.*

At all American Computers & Engineers offices in:

California
2855 Telegraph Avenue
Suite 508
Berkeley, CA 94705
Telephone: (415) 849-0177

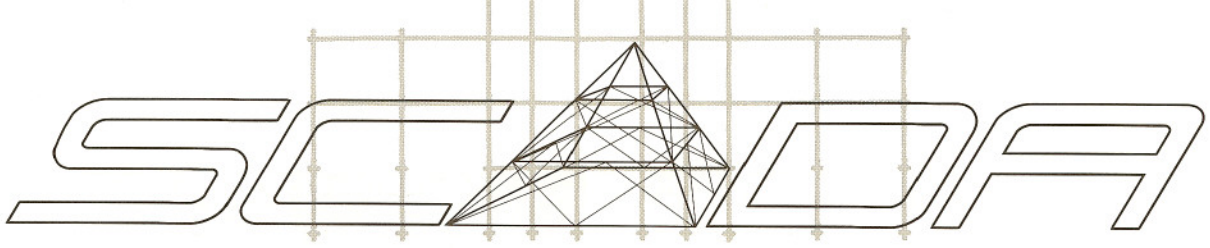
2001 South Barrington Avenue
Suite 204
Los Angeles, CA 90025
Telephone: (213) 447-6751
Telex: 910-342-6365

4141 MacArthur Blvd. Suite 216
Newport Beach, CA 92660
Telephone: (714) 851-8700

Canada
Deerfoot Business Centre
Suite 230, 6715 8th Street, N.E.
Calgary, Alberta
Canada T2E 7H7
Telephone: (403) 275-5871

France
55 Rue de Rivoli
75001 Paris, France
Telephone: 236-9495

Lebanon
Socomet/Bahsas
P.O. Box 214
Tripoli, Lebanon
Telephone: 628-300



designed by engineers . . . designed for engineers . . . supported by engineers worldwide

SCADA: A Structural Computer Aided Design & Analysis System

By L. Carter Wellford, Jr., Ph.D.,
Ghassan Dib, Ph.D., and
Brian Gordon

Businesses have been enjoying the benefits of the microcomputer revolution for the past seven years. Word processing and computerized accounting procedures have become state-of-the-art techniques and every business that has had growth in mind has invested or considered investing in the wizard problem solvers.

Every business? No, not quite every business. Structural engineering businesses were caught in a very peculiar situation. These businesses have a need for programs to be used in the analysis and design of their structures. The wealthy companies turned to time-sharing and gained access to powerful programs running on mainframes. They got their questions answered and received hefty bills equating CPU seconds to hundreds of dollars. These same companies could not economically involve their accounting departments, or for that matter, their word processing activities, with the mainframe computer. Some of the most aggressive companies equipped each of the remaining departments with specialized computers to do their specialized work. The result of the proliferation of computers has been a communications headache. So many operating systems to learn... so many terminals and printers to get used to...so many vendors to complain to...

The segmentation of computer capabilities in engineering businesses happened for a very natural reason. The engineering programmer must be an accomplished theoretician, an avid learner always aware of the state-of-the-art, and a programmer with good technical skills. In addition, he must have a full grasp of the meaning of the microcomputer, its future development and its impact on the end user, and he must have a little farsighted imagination to explain his trust that a microcomputer can accomplish so much for so little.

The situation, then, is very clear. Structural engineers currently rely on mainframe computers. This occurs principally because few engineering organizations or programmers have made—or can make—the tremendous investment necessary to generate structural design software for microcomputers.

A few years ago, the SCADA Systems Corporation, in conjunction with American Computers and Engineers, analyzed this situation, assembled the necessary engineering and programming expertise, and proceeded with the SCADA project. The SCADA system presented here is the result of that effort.

Continued Next Page

A Simple Structural Design Problem And The Advantages Of A Computer Analysis

Before beginning a detailed description of the SCADA system, let us discuss why it is so useful to structural engineers.

Often structural engineers—especially in small offices—must solve small structural problems. The problems could involve the design of a bent, a small truss, or one of many little problems that occur every week to keep an engineer busy. A typical structure of this type is shown in Figure 1.

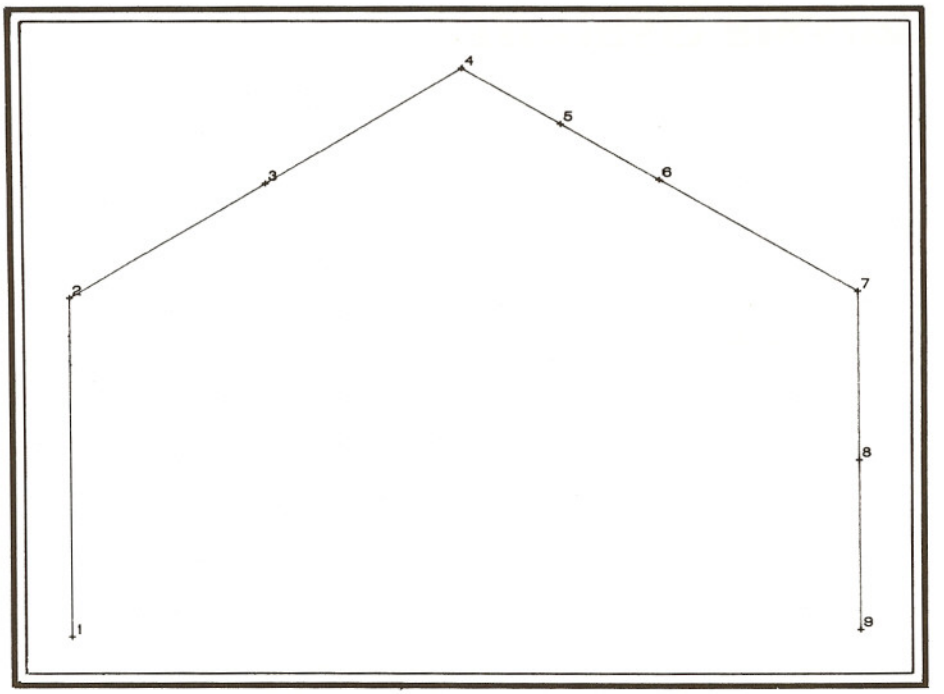


Figure 1 — Two dimensional Frame Sample

The problem is small. However, there are six joints and twelve unknown displacement components. In order to obtain the exact solution, a system of twelve equations in twelve unknowns must be solved. Even for this small structure, a computer must be used to obtain the exact solution. Engineers, working by hand, often use moment distribution, or slope deflection methods, to solve these small problems. These methods work very well as long as the structure in question is the same old structure with no hidden surprises. The normal process is to assume member sizes, analyze, alter member sizes, re-analyze, and so on. Repetitions of the design cycle can range from two to many more. A simple structure like the one shown in Figure 1 may take an engineer between four and six hours to analyze. If the engineer has a Cromemco computer with SCADA system software, the whole process—modeling, data input and solution—may take him less than thirty minutes. Clearly, even if we consider only small structures, the time savings for the engineer is well worth the cost of the computer and software. For large structural problems these savings are magnified.

The Scada System

Let us now consider the makeup of the SCADA System. The acronym SCADA stands for Structural Computer Aided Design and Analysis. This title may be confusing to some people. Often, when the words "computer aided design" are mentioned, the meaning is not particularly clear. In the context intended here, structural computer aided design and analysis encompasses the following topics:

A) Mathematical modeling of an engineering structure

B) Graphical display of the structural model

C) Structural analysis of the mathematical model of the structure

D) Graphical display of structural motion and structural internal forces, stresses, etc.

E) Design of individual structural members and stress checking, to verify the design of particular structural members.

There are certain tasks, associated with computer aided design, which the SCADA system does not carry out. At present, SCADA has no capability for the preparation of plan or detailed structural drawings. It is hoped that these capabilities can be included at a later date.

In relationship to SCADA, the word "structural" should be interpreted in its most generalized sense. The SCADA system can be used in the analysis and design of frame buildings, shear walls, plate structures, slabs, foundations, shells, tanks, mechanical parts, dams or, for that matter, airplanes.

The SCADA structural computer aided design and analysis system is composed of a series of modules or programs, available separately, which work together to allow the structural design to be carried out. The following programs are currently a part of the SCADA package:

A) SCADA/ANALYSIS: A structural analysis package based on finite element concepts which allow the static or dynamic analysis of complex structures.

B) SCADA/PLOT: A computer graphics module which allows the graphical display of the structure. This module can be used as either a preprocessor or a postprocessor for SCADA/ANALYSIS. It is capable of displaying the structure in three dimensions at user-defined viewing angles. It can provide plots of deflected structures, vibration modes, and transient responses of the structure at particular points. The software is currently operating on Tektronix equipment, using graphic plotters.

C) SCADA/BGEN: A preprocessor model generation program for building design, the module allows for the rapid interactive preparation of data for the analysis of two- and three-dimensional buildings. Various modeling assumptions involving joint motion are allowed. Shear walls

Continued Next Page

can be included. Coupled shear walls can be modeled.

D) SCADA/STEELD: An AISC steel design program, this module provides an AISC stress check for the structural design.

E) SCADA/CBEAM: A reinforced concrete beam design program, this module designs reinforced concrete beams based on the output of the ANALYSIS module. It is a fully interactive computer program for the design of simple and continuous reinforced concrete beams in full accordance with the requirements of the ultimate strength design method of the ACI code for rectangular and Tee beam cross-sections. The program is capable of considering moment reversals caused by moving loads or dynamic loadings.

F) SCADA/CCOLUMN: A reinforced concrete column design program, it is fully interactive with a method of solution based on the ultimate strength theory. It recognizes round and rectangular concrete cross sections with round, rectangular or irregular reinforcement patterns. It has the capability of generating interaction diagrams for uniaxial or biaxial bending and compression, or checking the adequacy of a cross-section to resist a given load combination. The method used in this program is more vigorous than most other methods used in current standards and design aids.

The Heart of the Program
The Analysis Module

In the analysis module of the program, the structure is modeled by breaking it up into its component parts. The overall structure is conponents is utilized to represent various parts of the structure. Finally, the computer is used to automatically assemble the components and obtain the final solution. In the SCADA system, standard "displacement methods" of matrix structural analysis are used. These methods have been taught to under-graduate structural engineering students for at least the last fifteen years, and are the standard engineering tool for computerized structural analysis.

Depending on the type of structure to be analyzed, the component structural parts can take many forms. In SCADA, various commonly used "finite element" models are used for the components. These components are defined as follows:

A) The 2-D Beam Member: used in the analysis of frame structures loaded in their plane. Distributed and concentrated member forces are considered. A typical example of a plane frame structure using 2-D beam elements is shown in Figure 2.

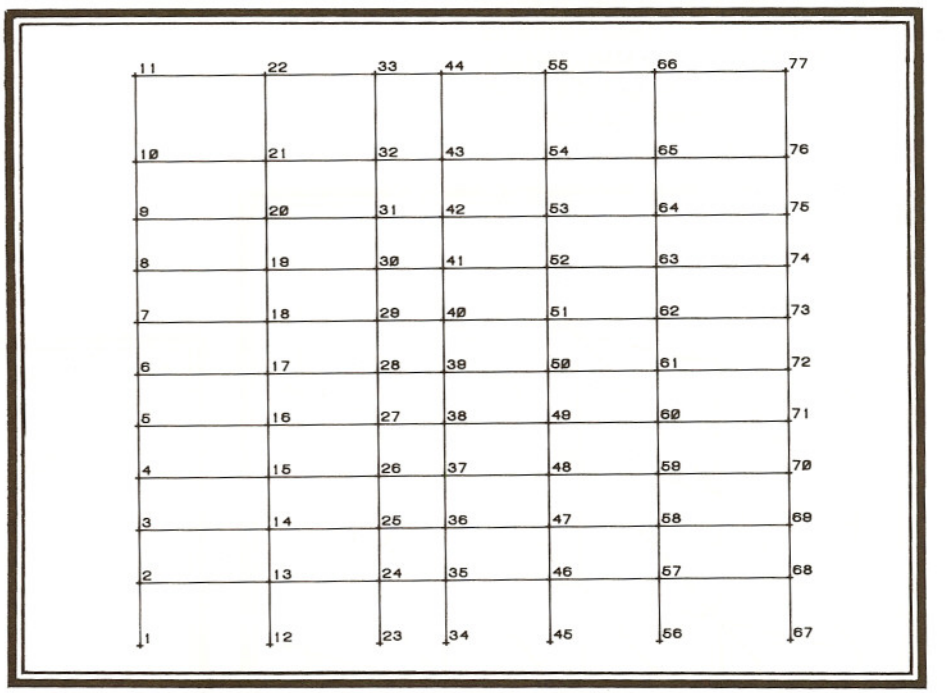


Figure 2 — 6-Bay Plane Frame Structure

B) The 3-D Beam Member: used in the analysis of frame structures which have general 3—d deformation patterns. A simplified notation for defining the member orientation is employed. A typical frame structure composed of 3-D beams is shown in Figure 3.

Continued Next Page

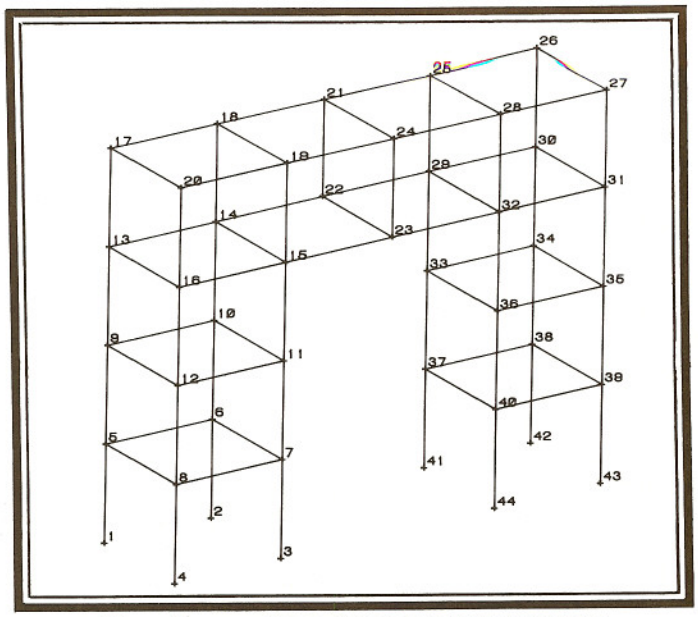


Figure 3 — Three-dimensional Frame Sample

C) The 3-D Truss Member: used in modeling two- and three-dimensional structures in which the members take only axial forces.

D) The Plate Element: used to model flat plates under the action of transverse loading. These elements are ideal for modeling slabs, retaining walls, etc. An example of a structure made of plate elements is shown in Figure 4.

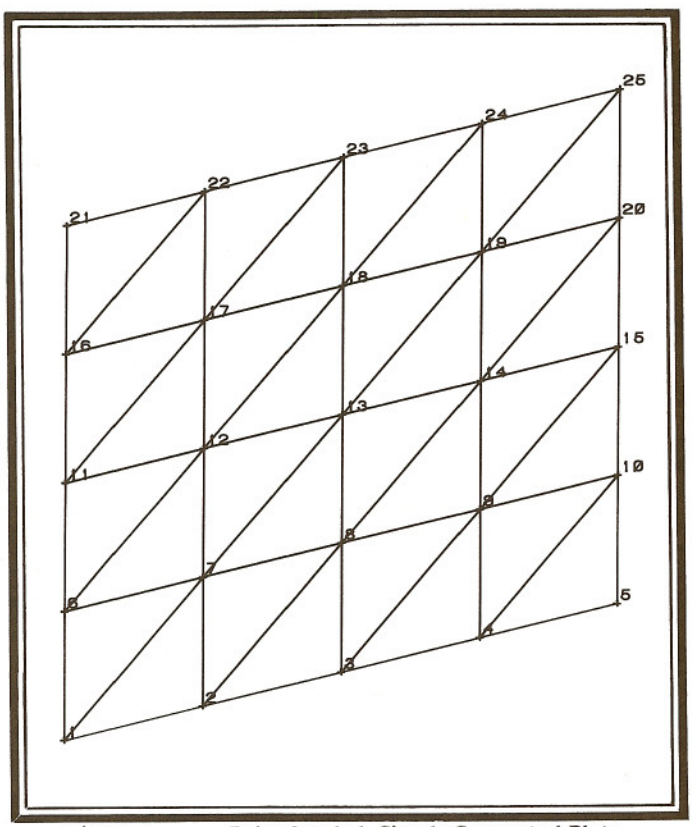


Figure 4 — Point Loaded, Simply Supported Plate

E) The Shell Element: used to model singly and doubly curved thin sheets which are elastic. These elements are ideal for structural applications, including the analysis of roofs, storage tanks, cooling towers, containment vessels, and other such structures. An example of a shell structural model is shown in Figure 5.

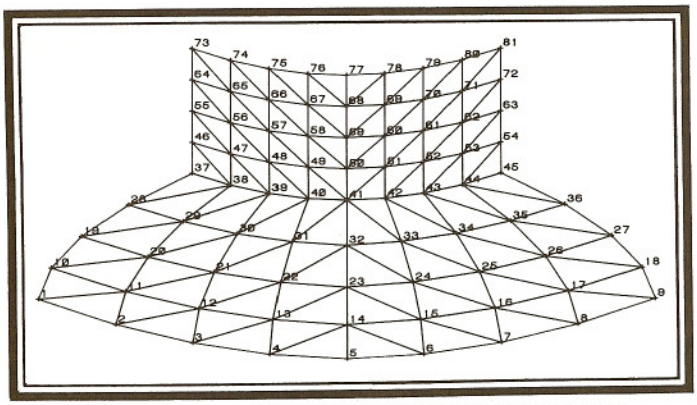


Figure 5 — Pointed Loaded Thin Shell Structure

F) The Plane Stress and Plane Strain Elements: used to model the planar motion of thick elastic structures, including thick beams, arches and rings. In addition, these elements can be used to model mechanical parts, shear walls, thin panels, and other assorted structures. These elements have a variable number of nodes—from three to nine. They can be highly complicated parts. A typical plane stress model of a thick ring is shown in Figure 6.

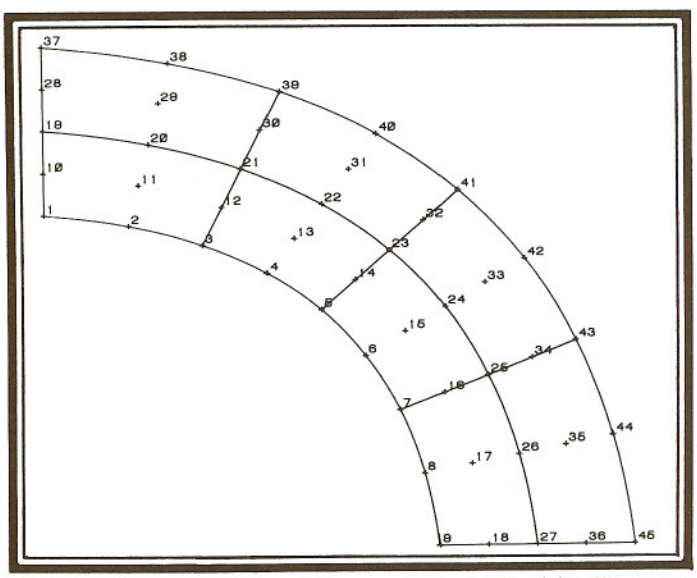


Figure 6 — Thick Curved Beam — 9 Node Elasticity Elements

G) The Axisymmetric Element: used to model structures which are

Continued Next Page

geometrically rotationally symmetric, relative to a certain axis. Typical structures of this type include the axisymmetric shell, the tank, the containment vessel, among others.

H) The 3-D Elastic Element: used to represent a structure which is thick and whose motion is basically three-dimensional. These structures could be dams, thick three-dimensional shells, valves, thick pipes, and other massive structures. An example of the 3-D elasticity element is shown in Figure 7. The model represents an earth dam and is composed of eight node elements.

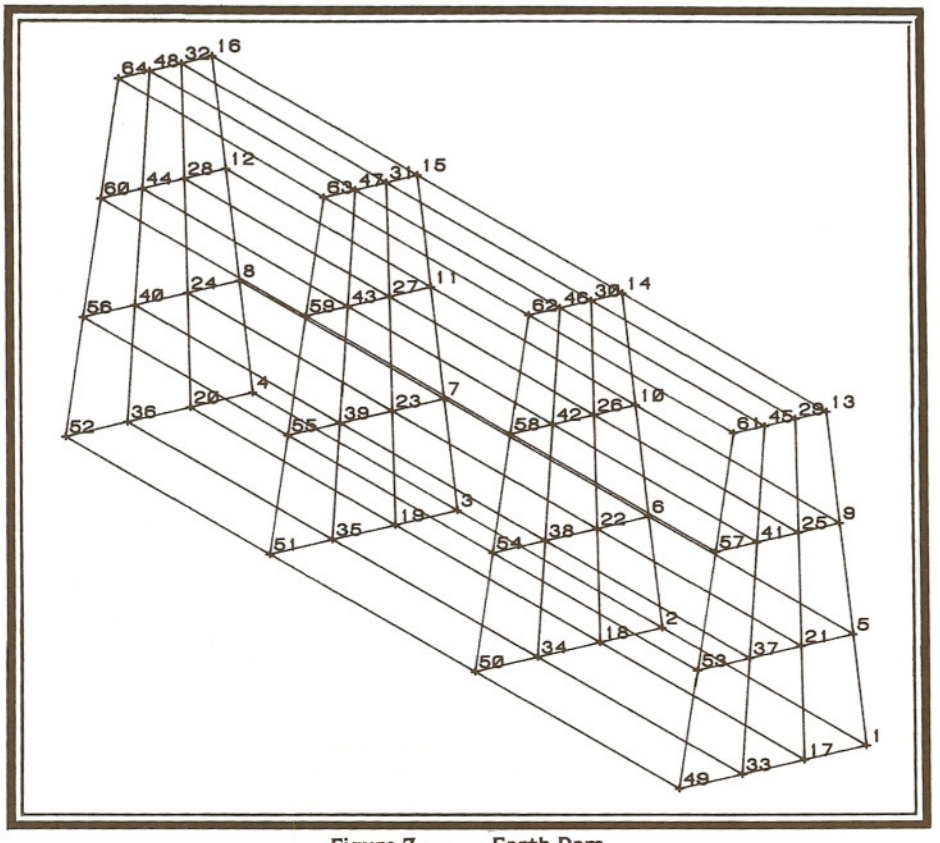


Figure 7 — Earth Dam

The analysis module is designed to work in either the static or dynamic mode. In the static mode the deformation, internal forces, and stresses in structures are predicted for loading conditions in which the applied forces are not dependent on time. In the dynamic mode the natural frequencies and vibration modes of the structure are determined. In addition, mode superposition methods are used to determine the dynamic response of the structure. The motion and dynamic loading of the structure are determined either through a time history analysis or through a response spectrum frequency domain analysis.

In developing the SCADA/ANALYSIS module, a certain philosophy of program development has been used. This philosophy is based on the belief that there should not be any inherent limitation to the size of a problem or structure to be solved by the program. In order to ensure that no such limitation exists in SCADA, care has been taken to be able to do all work in an **out-of-core mode.** When essential, SCADA does all operation—be it reading of input data, solution of equations, or calculation of forces—in an out-of-core manner. Thus, in using SCADA, there are no limitations to the number of joints, number of members, or number of equations to be solved. For this reason, SCADA can be used with a memory area of any size, from 64K on up.

Since there is no inherent limitation on problem size in the program itself, the limiting factor becomes the size of the available low speed storage: disk space. The user can purchase a system—be it a floppy disk system or a hard disk system—with enough low speed storage to meet his individual requirements. In this regard, the minimum size floppy-based system on which SCADA will operate comfortably is a system with two, eight inch drives (double sided, double density). Systems with five inch drives should be avoided unless they are used in conjunction with a hard disk.

In defining the architecture of the SCADA analysis module, the emphasis has been on providing a program which is **modular** and **expandable.** The **modularity** is handy on a microcomputer because some of the options available in the general purpose program may not be useful to individual users. for instance, the program can be reduced in size by simply leaving out the dynamics module if no dynamical problems are to be solved. Or, the renumbering module can be omitted if no renumbering is to be done. Or, the out-of-core solution schemes can be dropped if all structures to be considered are small and solvable in core. In addition, individual structural elements which are not to be used by a certain individual can be dropped from the analysis module. The program will still execute in the normal way.

The **expandability** of the program is also a useful feature. New element types can be added easily. They can be added as new program segments. The existing program segments need not be altered in order to accommodate the new element types.

Because SCADA operates in the out-of-core mode, and because SCADA is modular and expandable, the program acts just like a standard structural code on a mainframe or super-mini. The same structures are solvable. The input procedures are similar, and the output procedures are similar. The solution process will be more time-consuming using the microcomputer; however, the computer is right there on the engineer's desk. he has instant access, and he has the highest priority for its use. Thus, the true elapsed time for a structural solution will often be less than if the problem were solved on a mainframe.

Continued Next Page

The Supporting Modules
The Plot Module

The SCADA/PLOT module can, in many ways, make the structural analysis and design work of the engineer easier. When Plot is used in its preprocessor mode, a representation of the structure before deformation is provided. The individual joints are numbered in the preprocessing plots. These plots of the undeformed structure provide a visual record to the engineer as to the geometry and connectivity of the structural model. These plots can be invaluable in interpreting the output of the program.

As the structure grows in size, the amount of input data also expands. Occasionally the engineer will make small errors in specifying the input data. Without a visual presentation of the structure generated by the specific input data, it can be difficult to find these small errors. The engineer can simply run the program, and then check the results for their reasonableness. This process can be very time consuming, and the output may not always indicate the exact source of the error. However, using the PLOT module, the engineer can quickly plot the structural geometry before running the program. Any input errors in the structural geometry will be immediately observable from the graphic display.

In the postprocessing mode, the deflections of the loaded structure are displayed. These deflected structural plots can provide the engineer with a physical feel and insight into the behavior of the structure under load. Anomalous behavior, such as large local deflections, may point the way to a missing member, incorrect member property, etc. The graphical option of SCADA can highlight mistakes at a very early stage in the design. This can help the engineer realize considerable savings in time and effort.

A typical plot provided by SCADA/PLOT is shown in Figure 8.

In viewing a complex structure in either its deformed or undeformed position, it may be useful to use the ZOOM option in SCADA/PLOT. The ZOOM feature allows a portion of the structure to be isolated and plotted in an expanded form. Figure 9 shows a typical structural plot in which the ZOOM option has been utilized.

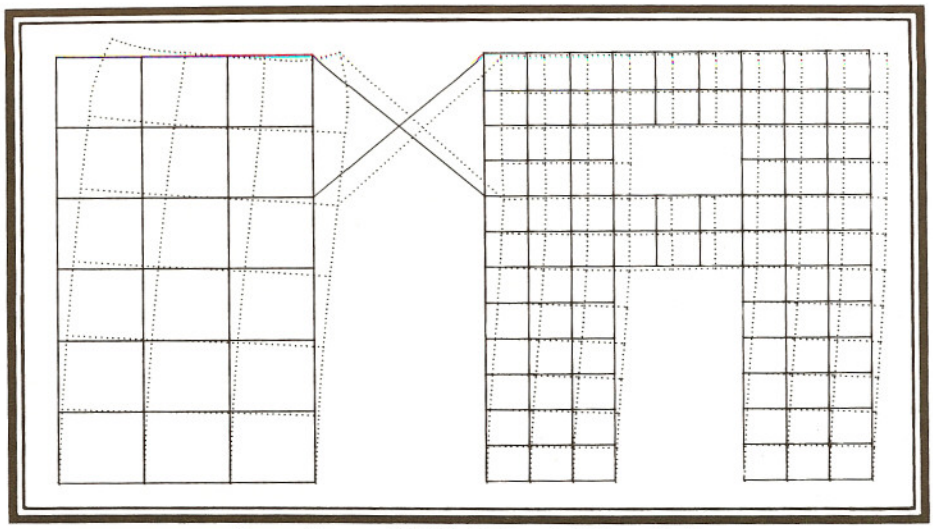


Figure 8 — 207 Node Coupled Sheer Wall

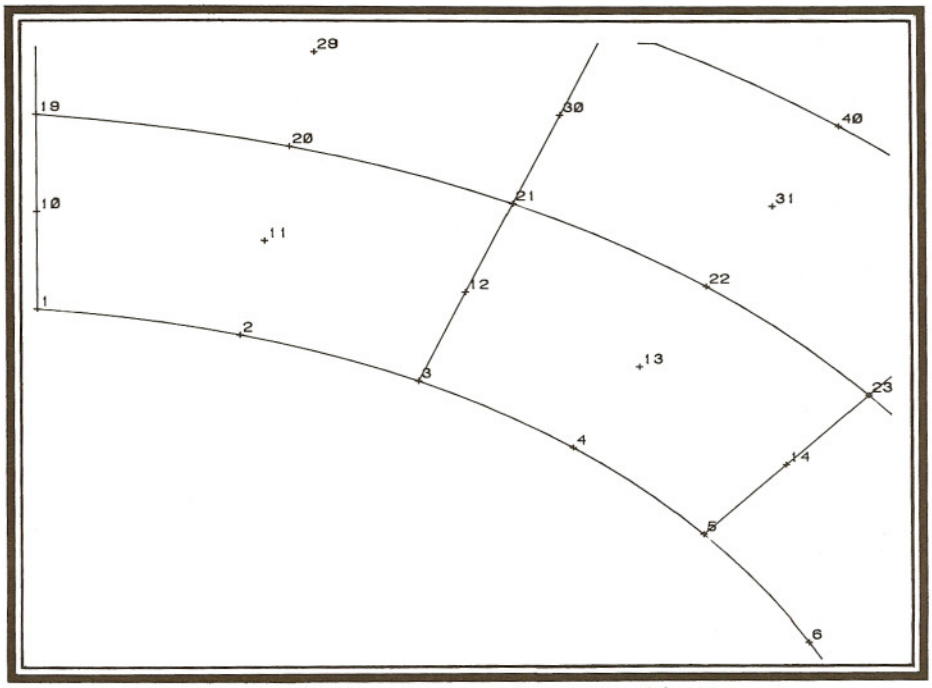


Figure 9 — Thick Curved Beam — 9 Node Elasticity Elements

"The BGEN Module

SCADA provides a rich set of capabilities for modeling a variety of structures. However, many Engineering Professionals will typically be satisfied and successful users of a subset of SCADA's capabilities. It was with this in mind that the SCADA module, BGEN, was developed.

BGEN is a so-called, "preprocessor," which facilitates the creation of input data files for analysis for SCADA. Many framed structures can be modeled using two-dimensional beam elements. Further, many structures are orthogonally framed. That is, all of the members are parallel to the principal axes and, as a result, they are at right angles to each other.

BGEN provides the user with an interactive question and answer session. During this session, the user is prompted for sufficient information to completely define a structure. In addition, BGEN requests loading information which forms the basis for analyzing a lateral point load case.

The input data file thus created by BGEN can be further modified using the usual SCADA input preparation procedures. However, it is impor-

Continued Next Page

```
{001} FILE NAME:' <testbldg>
{002} OUTPUT HEADING:     <This is an example of a GEN-generated structure.>
{003}
{004}                  MODELING PROCEDURE
{005}
{006} ARE AXIAL DEFORMATIONS ALLOWED IN BEAMS: YES OR NO [N] <Y>
{007} ARE AXIAL DEFORMATIONS ALLOWED IN COLUMNS: YES OR NO [Y] <cr>
{008}
{009}      TYPICAL JOINT RELEASES AT BEAM-COLUMN INTERSECTIONS
{010}          HORIZONTAL DISPLACEMENTS ___ RELEASED
{011}          VERTICAL DISPLACEMENTS _____ RELEASED
{012}          ROTATIONS _________________ RELEASED
{013}
{014} NUMBER OF BAYS: <9>
{015} NUMBER OF FLOORS: <29>
{016} WIDTH OF BAY NO. 1: <480>
{017} WIDTH OF BAY NO. 2: <480>
{018} WIDTH OF BAY NO. 3: <240>
  .
  .
  .
{024} WIDTH OF BAY NO. 9: <480>
{025} HEIGHT OF LEVEL NO. 1: <192>
{026} HOW MANY CONSECUTIVE FLOORS HAVE THIS SAME CONFIGURATION? [1] <3>
{027} GENERATING COORDINATES AND JOINT RESTRAINTS
{028}
{029} FIRST COLUMN LINE NUMBER OF NEXT FLOOR: [1] <3>
{029} LAST COLUMN LINE NUMBER OF NEXT FLOOR: [10] <8>
{030} HEIGHT OF LEVEL NO. 4: <144>
{031} HOW MANY CONSECUTIVE FLOORS HAVE THIS SAME CONFIGURATION? [1] <12>
{032} GENERATING COORDINATES AND JOINT RESTRAINTS
  .
  .
  .
{046} FIRST COLUMN LINE NUMBER OF NEXT FLOOR: [3] <4>
{047} LAST COLUMN LINE NUMBER OF NEXT FLOOR: [8] <7>
{048} HEIGHT OF LEVEL NO. 29: <240>
{049} HOW MANY CONSECUTIVE FLOORS HAVE THIS SAME CONFIGURATION? [1] <cr>
{050} GENERATING COORDINATES AND JOINT RESTRAINTS
{051} FORCE SECTION
{052} LATERAL FORCES Y OR N [Y] <cr>
{053} LATERAL FORCE AT LEVEL 2: <2>
{054} LATERAL FORCE AT LEVEL 3: <2>
  .
  .
  .
{081} LATERAL FORCE AT LEVEL 30: <4>
{082}
{083} MATERIAL PROPERTY NUMBER 1
{084} MEMBER AREA: <31.8>
{085} MOMENT OF INERTIA: <4470>
{086} MODULUS OF ELASTICITY: <30000>
{087}
{088} MATERIAL PROPERTY NUMBER 2
{089} MEMBER AREA: <24.2>
{090} MOMENT OF INERTIA: <1760>
{091} MODULUS OF ELASTICITY: <30000>
  .
  .
  .
{104} MATERIAL PROPERTY NUMBER 5
{105} MEMBER AREA: <cr>
{106} MOMENT OF INERTIA: <cr>
{107} MODULUS OF ELASTICITY: <cr>
{108}
{109} BEAM MATERIAL PROPERTIES
{110} ENTER NUMBER FROM MATARIAL PROPERTY TABLE
{111} BEAM MATERIAL PROPERTY AT BAY 1 AND LEVEL 2: <cr>
{112}
{113} BEAM MATERIAL PROPERTY AT BAY 2 AND LEVEL 2: <cr>
{114}
{115} BEAM MATERIAL PROPERTY AT BAY 3 AND LEVEL 2: <1H5>
{116}
{117} BEAM MATERIAL PROPERTY AT BAY 8 AND LEVEL 2: <cr>
{118}
{119} BEAM MATERIAL PROPERTY AT BAY 9 AND LEVEL 2: <cr>
{120}
{121} BEAM MATERIAL PROPERTY AT BAY 1 AND LEVEL 3: <1H9V2>
{122}
{123} BEAM MATERIAL PROPERTY AT BAY 3 AND LEVEL 5: <2H5V25>
{124}
{125} BEAM MATERIAL PROPERTY AT BAY 4 AND LEVEL 20: <2H3>
{126}
{127} COLUMN MATERIAL PROPERTIES
{128} ENTER PROPERTIES FROM MATERIAL PROPERTY TABLE
{129} COLUMN MATERIAL PROPERTY AT COLUMN LINE 1 AND LEVEL 1: <3H10V3>
{130}
{131} COLUMN MATERIAL PROPERTY AT COLUMN LINE 3 AND LEVEL 4: <4H6V25>
{132}
{133} COLUMN MATERIAL PROPERTY AT COLUMN LINE 4 AND LEVEL 29: <4H4>
{134} STOP
```

Figure 10

tant to note that the input file created by BGEN can be submitted directly to SCADA for analysis. The SCADA-generated results will be the same as those produced for the non-BGEN user.

A Sample Input Session

The following is an example of BGEN being used to model a nine-bay, 29-story building frame. Figure 10 is a facsimile of the interactive session hosted by the BGEN module.

Each of the lines in Figure 10 has been preceded by a line number bracketted by "{____}". These line numbers are not generated by BGEN and are for reference purposes only. The user responses to the BGEN prompts are bracketted by "<____>". In addition, the user response, "<cr>", indicates that the user responded by pressing the carriage return key only.

Line 1 prompts the user for a file name which will be used for the input data file to be created. Next, line 2 requests an output heading which will be displayed on any subsequent graphical output.

BGEN then asks the user if axial deformations are allowed in the beams and columns at lines 6 and 7 respectively. The default responses are enclosed by "[____]". The typical joint conditions are summarized next by lines 4 through 12.

Next, at lines 14 and 15 the user is prompted for the number of bays and the number of floors in the structure. BGEN then requests the width of each of the bays in turn. A consistent set of units must be observed throughout the BGEN session. In this example, lengths are expressed in inches and forces are given in kips. (Note that 1 kip = 1000 pounds.)

The preceding user responses define the column line grid to be used for the balance of the structure. In this example, the column lines are from 1 to 10. At lines 25 through 50, BGEN cycles through a series of prompts which allow the user to define floor configurations either singly or in groups. Following each such definition, BGEN generates the related coordinates and joint restraints.

At line 52 BGEN asks if lateral forces are to be modeled and offers

Continued Next Page

the default response [Y]. In this example, the default response is made and the lateral loads (in kips) are typed in for each level in the structure.

The material properties are defined for each of four member property sets at lines 83 through 107. The prompting for material properties by BGEN is stopped by three "<cr>" user responses. Again, the use of consistent units is observed.

Finally, the sets of material properties are associated with the beams and columns in the structure at lines 109 through 125 and lines 127 and 133 respectively. The user responses to BGEN's requests for material property numbers at specific locations may include H (horizontal) and V (vertical) extensions.

A response of, "2H5V25", for example, would associate material property set 2 with the subject member. This material property set would also be associated with the next 4 members horizontally and the next 24 members vertically in a sweeping manner. Thus, 125 material property assignments would be made with this one response.

The "STOP" message at line 134 indicates that the BGEN session is complete and that the input file created is ready for further modification or for submission to SCADA.

```
INITIAL
    This is an example of a GEN-generated structure.
J=194 S=2 P=1
G=1 C=1
MP=4 ML=1 R=0
D=0

COORD
NC=1 PS=0.00000,0.00000,0.00000
NC=2 PS=480.00000,0.00000,0.00000
NC=3 PS=960.00000,0.00000,0.00000
 .
 .
 .

NC=194 PS=2040.00000,4512.00000,0.00000

JOINT
A=1 K=0,0,0,0,0,0
A=2 K=0,0,0,0,0,0
A=3 K=0,0,0,0,0,0
 .
 .
 .

A=194 K=1,1,0,0,0,1

FORCE
NF=11,1 LD=2.0000,0,0,0,0,0
NF=21,1 LD=2.0000,0,0,0,0,0
NF=31,1 LD=2.0000,0,0,0,0,0
 .
 .
 .

NF=191,1 LD=4.0000,0,0,0,0,0

BEAM2D
NP=1 PR=31.8000,4470.0000,30000.0000
NP=2 PR=24.2000,1760.0000,30000.0000
NP=3 PR=94.1000,4140.0000,30000.0000
NP=4 PR=72.3000,3230.0000,30000.0000

M=1,13,14 PL=1 P=1 RL=0,0,0 D=0,0
M=2,14,15 PL=1 P=1 RL=0,0,0 D=0,0
M=3,15,16 PL=1 P=1 RL=0,0,0 D=0,0
 .
 .
 .

M=335,189,194 PL=1 P=4 RL=0,0,0 D=0,0

END
```

Figure 11

The BGEN Created Input File

The input file created by the preceding session describes a structure having 194 joints and 335 members. The file is over 25,000 bytes in length or about 12 pages when listed. An abbreviated one-page facsimile of this file is presented as Figure 11.

With reference to figure 11, the "INITIAL" section provides general information about the structure, the solution technique, the members and the loading on the structure. The "COORD" section defines the geometry of the structure. The "JOINT" section defines the joint restraints

The "FORCE" section lists the forces which are to be imposed upon the structure. Finally, the "BEAM2D" section lists the sets of member properties as well as the individual member incidences and other member information.

The SCADA Output

The output file produced by SCADA for this example is over 90,000 bytes in length and when listed, it occupies 26 pages. An abbreviated three-page facsimile of this information is presented as figure 12.

Briefly, this information represents the results of SCADA's analysis. The early tables present the conditions of the structural model and track SCADA's progress during its analysis. The last two tables provide the results of this analysis. These tables list the displacements at each joint in the structure and the forces

Continued Next Page

```
TITLE .....     This is an example of a GEN-generated structure.

INPUT DATA FILE NAME ..........................  TESTBLDG
NUMBER OF JOINTS ..............................   194
SOLUTION METHOD ...............................     2
POSTPROCESSING PARAMETER ......................     1
NUMBER OF LOAD CASES ..........................     1
MAXIMUM NUMBER OF MATERIAL PROPERTIES  ........     4
MAXIMUM NUMBER OF MEMBER LOAD CONDITIONS  ...     1
NODE RENUMBERING FLAG  ........................     0
DYNAMICS FLAG  ................................     0

NUMBER OF ELEMENT GROUPS  ...  1   ELEMENT GROUPS  ...   1

NODE-POINT      X       Y       Z  X-ROT.  Y-ROT.  Z-ROT.

       1        0       0       0       0       0       0
       2        0       0       0       0       0       0
       3        0       0       0       0       0       0
         .
         .
         .
     194      550     551       0       0       0     552

GENERATED COORDINATE DATA

NODE       X-COORD       Y-COORD       Z-COORD
   1    .0000E+01     .0000E+01     .0000E+01
   2    .4800E+03     .0000E+01     .0000E+01
   3    .9600E+03     .0000E+01     .0000E+01
     .
     .
     .
 194    .2040E+04     .4512E+04     .0000E+01

APPLIED CONCENTRATED FORCES

LOAD CASE  JOINT         FX         FY         FZ         MX         MY         MZ
        1     11    .20E+01    .00E+01    .00E+01    .00E+01    .00E+01    .00E+01
              21    .20E+01    .00E+01    .00E+01    .00E+01    .00E+01    .00E+01
              31    .20E+01    .00E+01    .00E+01    .00E+01    .00E+01    .00E+01
                 .
                 .
                 .
             191    .40E+01    .00E+01    .00E+01    .00E+01    .00E+01    .00E+01

PROBLEM SIZE PARAMETERS

NUMBER OF EQUATIONS  ...................    552
STIFFNESS MATRIX SIZE  .................  11337
AVERAGE COLUMN HEIGHT  .................     21
MAXIMUM COLUMN HEIGHT  .................     33

TIME ESTIMATE

LOADING PROGRAMS  .....      3.00 MIN.
GLOBAL DATA PHASE  ....     14.34 MIN.
ELEMENT DATA PHASE  ...      8.37 MIN.
MATRIX FORMATION  .....      3.07 MIN.
ASSEMBLY PHASE  .......      2.12 MIN.
SOLUTION PHASE  .......      2.92 MIN.
FORCE PHASE  ..........      7.26 MIN.
TOTAL TIME  ...........     41.09 MIN.

END OF GLOBAL DATA INPUT PHASE

ELEMENT INPUT PHASE

2-D BEAM ELEMENTS

MAT. PROPERTY          AE          EI          GA
            1   .9540E+06   .1341E+09   .0000E+01
            2   .7260E+06   .5280E+08   .0000E+01
            3   .2823E+07   .1242E+09   .0000E+01
            4   .2169E+07   .9690E+08   .0000E+01

MEMBER PARAMETERS

  ELE  I-END  J-END  PLANE  PROP.     OFF.-I     OFF.-J      RELEASES
                                                        (I-MOM. J-MOM. A-FOR.)
    1     13     14      1      1   .00E+01    .00E+01    0    0    0
    2     14     15      1      1   .00E+01    .00E+01    0    0    0
    3     15     16      1      1   .00E+01    .00E+01    0    0    0
      .
      .
      .
  335    189    194      1      4   .00E+01    .00E+01    0    0    0

END OF ELEMENT INPUT PHASE

MATRIX GENERATION PHASE

MATRIX GENERATION - 2-D BEAM ELEMENTS

ELEMENT   15 COMPLETED
ELEMENT   30 COMPLETED
ELEMENT   45 COMPLETED
  .
  .
  .
ELEMENT  330 COMPLETED
GENERATION COMPLETE FOR   335 ELEMENTS

END OF MATRIX GENERATION PHASE

ASSEMBLY PHASE

OUT-OF-CORE ASSEMBLY(OASSEM1)

BLOCK     5 ASSEMBLED
ASSEMBLY COMPLETE FOR     7 BLOCKS

END OF ASSEMBLY PHASE

SOLUTION PHASE

OUT-OF-CORE SOLUTION(OUTSOL1)

DECOMPOSITION FINISHED FOR BLOCK     5
DECOMPOSITION COMPLETE -    7  BLOCKS PROCESSED

DISPLACEMENTS AT JOINTS

JOINT    X-DISPL    Y-DISPL    Z-DISPL    X-ROTAT    Y-ROTAT    Z-ROTAT
    1   .000E+01   .000E+01   .000E+01   .000E+01   .000E+01   .000E+01
    2   .000E+01   .000E+01   .000E+01   .000E+01   .000E+01   .000E+01
    3   .000E+01   .000E+01   .000E+01   .000E+01   .000E+01   .000E+01
      .
      .
      .
  194   .415E+01  -.263E-01   .000E+01   .000E+01   .000E+01  -.290E-03

END OF SOLUTION PHASE

ELEMENT INTERNAL FORCE PHASE

LOAD CASE   1

INTERNAL FORCES FOR 2-D BEAM MEMBERS

                  I-END                                  J-END
MEMB  AXIAL FORCE SHEAR FORCE      MOMENT  AXIAL FORCE SHEAR FORCE      MOMENT
   1   .2450E+00   .1243E+02   .1606E+04  -.2450E+00   .1243E+02  -.1377E+04
   2   .3980E+00   .1080E+02   .1267E+04  -.3980E+00   .1080E+02  -.1324E+04
   3   .1926E+00   .5686E+01   .1024E+04  -.1926E+00   .5686E+01  -.1023E+04
     .
     .
     .
 335   .4952E-01  -.1222E+00   .2637E+01  -.4952E-01  -.1222E+00   .3197E+02

END OF INTERNAL FORCE PHASE
```

Figure 12

Continued Next Page

at each end of every member modeled.

A graphical representation of the structure was produced by SCADA and is presented as Figure 13.

Example Case

The capability and efficiency of the program are indicated in Table 1. Results for both small and large structures composed of the various structural components are presented in this table. For most of the test case, deflection plots are presented in Figures whose numbers are referred to in the Table. It should be noted that for Case #3 two deflection plots are provided. Figure 16 is the vertical

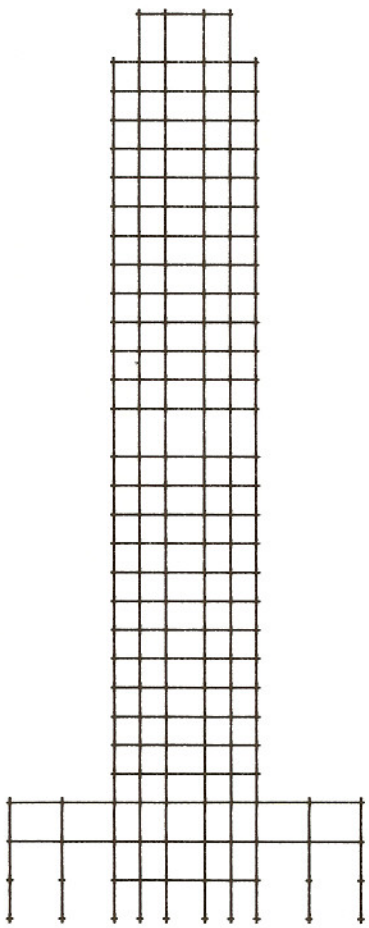


Figure 13A

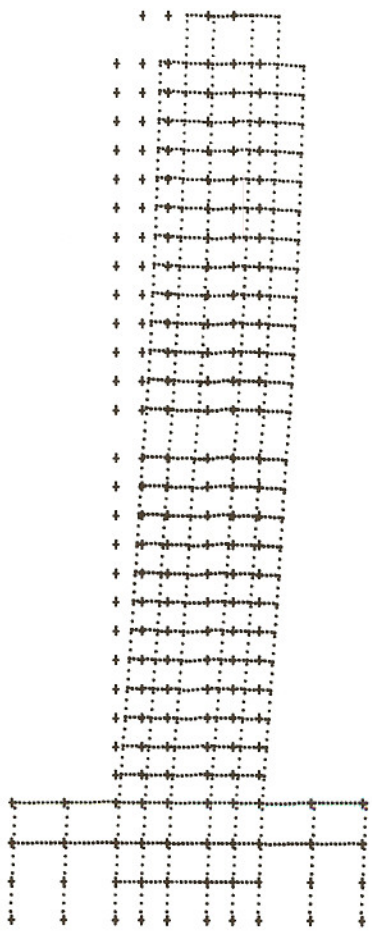


Figure 13B

Table 1

Case	Description	# Of Joints	# Of Elements	# Of Equations	# Of Entries In Stiffness Matrix	Avg. Column Height	Max. Column Height	# Of Load Cycles	Figure Number	Maximum Elapsed Times (Min.)	Solution Types: Out-Of-Core-In-Core
1	portal frame	9	8	21	94	5	6	3	1, 14	3 min.	IC
2	earth dam	64	25	144	5652	40	54	1	7, 15	29 min.	OC
3	plane frame	78	130	213	5997	29	33	3	2, 16, 17	27 min.	OC
4	thick ring	45	8	80	1856	24	38	2	6, 18	8 min.	IC
5	simply supported plate	25	32	59	823	14	19	1	4, 19	10 min.	IC
6	coupled shear wall	207	102	384	8400	22	256	1	8	28 min.	OC
7	35-story/10-bay plane frame	396	735	1155	39426	35	36	1	—	75 min.	OC
8	50-story/10 bay plane frame	561	1040	1650	56751	35	36	1	—	120 min.	OC
9	75-story/10-bay plane frame	836	1575	2475	85626	35	36	1	—	150 min.	OC
10	Shell (vertical load at pt. 30)	81	128	414	19505	48	58	1	20	75 min.	OC
11	3-D frame structure	44	76	236	11388	49	101	1	3	20 min.	OC
12	3-D frame structure —7 bays/50 stories	400	742	1728	67140	39	42	1	—	120 min.	OC

load case. Figure 17 is the wind load case.

In Table 1 all cases were run on the CROMEMCO SYSTEM 1H (Hard Disk). Elapsed times are for the complete solutions including the calculation of member forces and stresses.

Finally...

SCADA is a powerful analysis and design system that can, both statistically and dynamically, analyze two- and three-dimensional structures composed of BEAM and TRUSS elements, together with ELASTIC PLANE, PLATE and BRICK elements. SCADA is capable of providing a display on either a plotter or a storage tube for visualization of the output and model verification.

The opportunity to use a relatively inexpensive in-house microcomputer for experimentation and analysis, as opposed to a subcontracted mainframe or no computer at all, is just one of the reasons why the SCADA software package is becoming so popular. Variations in the values associated with the problem can be introduced with such ease and minimal cost that the final microcomputer model solution will be not only more economical, but also more elegant.

SCADA provides the power and capability of a mainframe with the convenience of a microcomputer. It allows engineers to enjoy direct access to, and hands-on integration of design processes. Free-format data entry enables the engineer to input data in a most convenient manner. SCADA produces a solution within minutes, and with a high degree of accuracy. The speed of the program is also impressive.

All these features make SCADA an ideal tool for the practicing structural engineer.

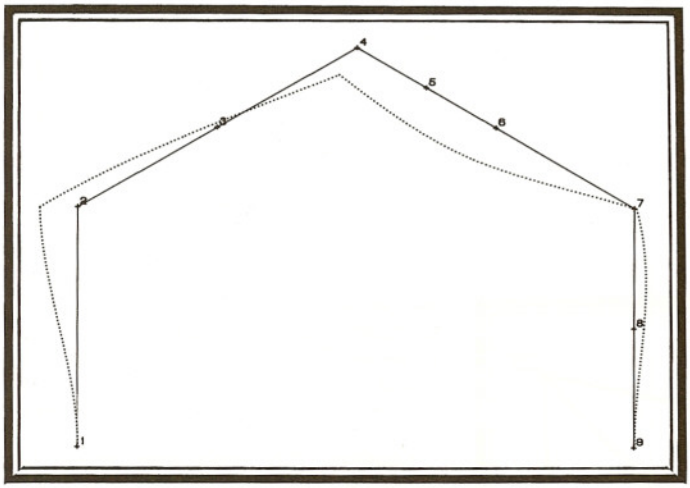


Figure 14 — Two-dimensional Frame Sample

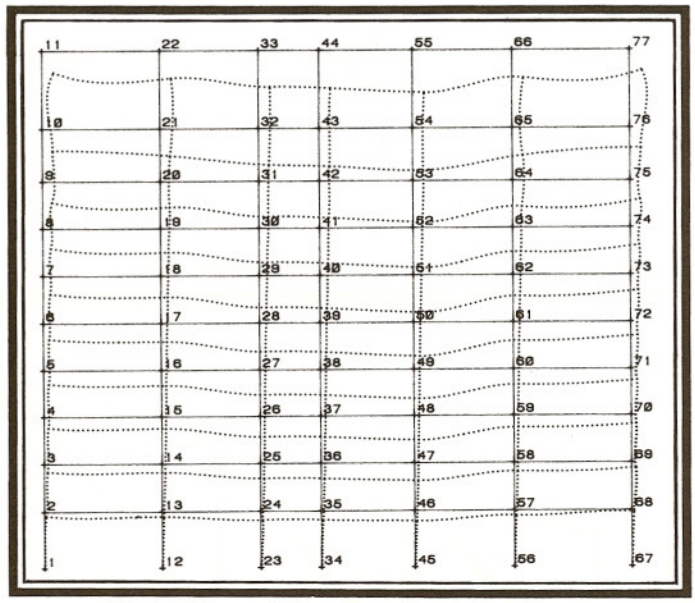


Figure 16 — 6-Bay Plane Frame Structure

Figure 15 — Earth Dam

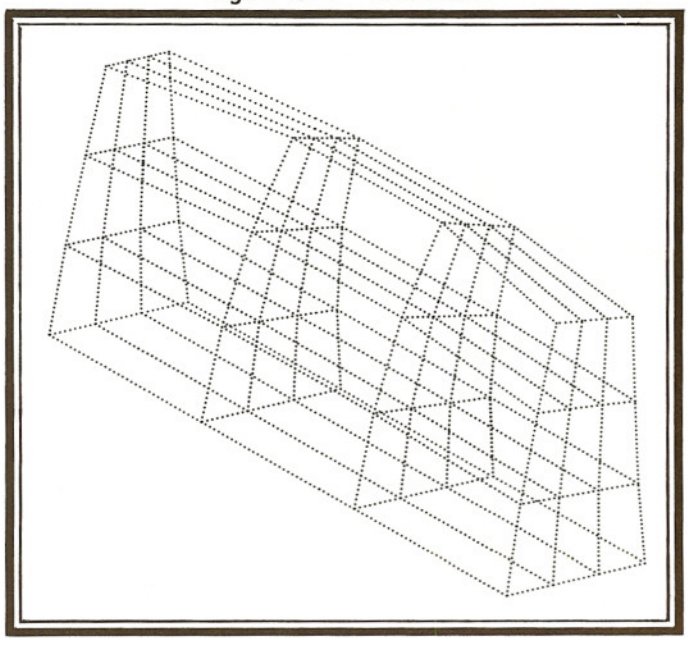
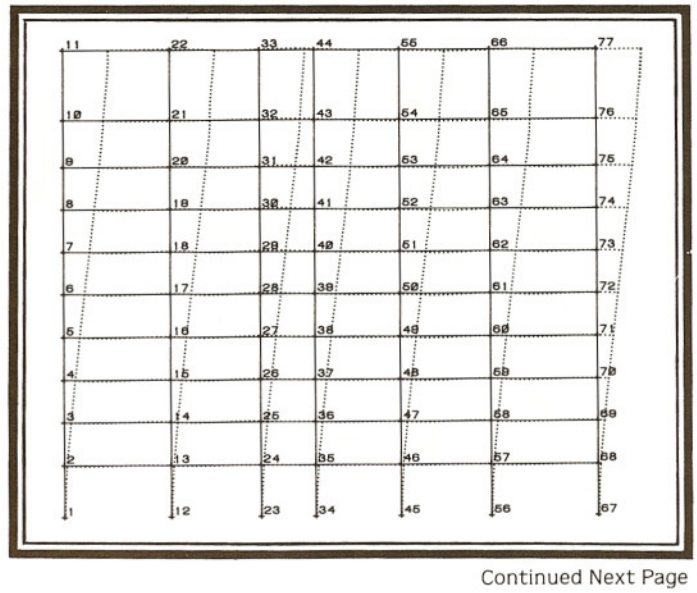


Figure 17 — 6-Bay Plane Frame Structure



Continued Next Page

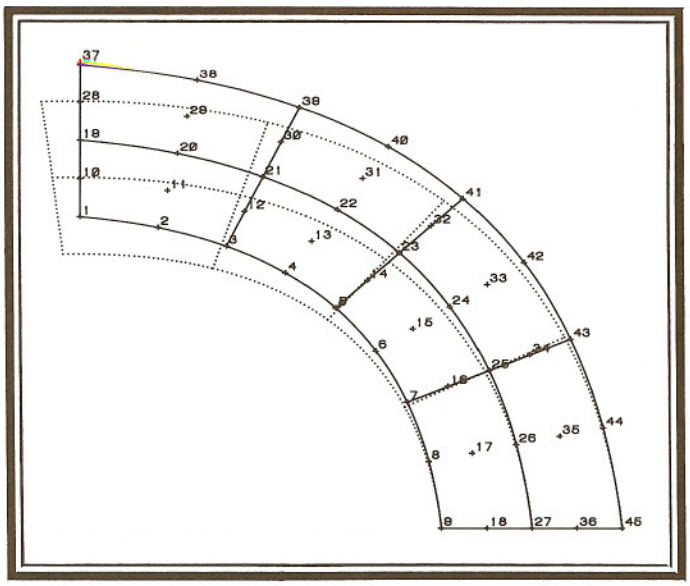


Figure 18 — Thick Curved Beam — 9 Node Elasticity Elements

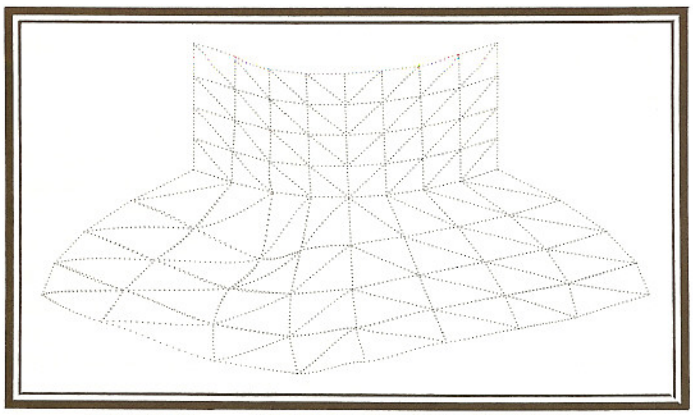
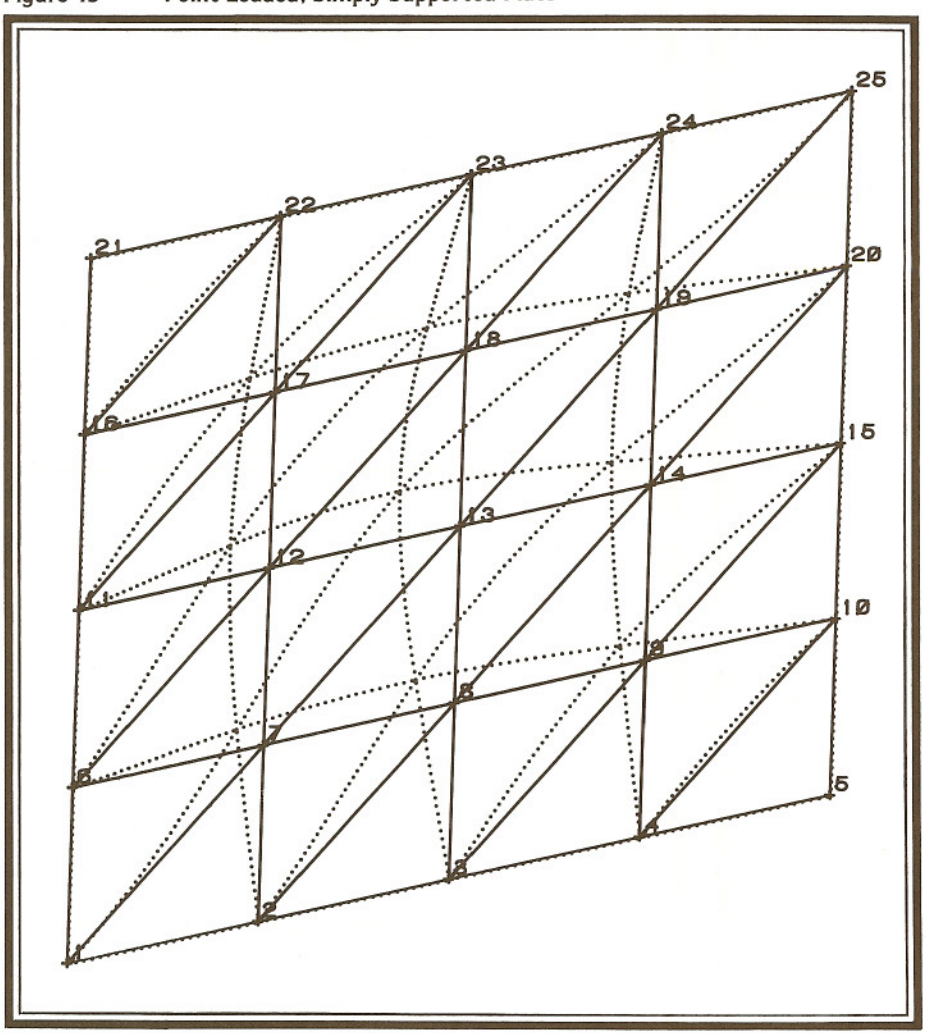


Figure 20 — Point Loaded Thin Shell Structure

Figure 19 — Point Loaded, Simply Supported Plate



About the Authors

Dr. L. Carter Wellford, Jr. is an Associate Professor of Civil Engineering at the University of Southern California. He received the B.S.M.E. degree from the University of Virginia, and his M.S. and Ph.D. degrees in Mechanical Engineering from the University of Alabama. He did Post Doctoral work at the Texas Institute of Computational Mechanics at the University of Texas in Austin, followed by seven years in industry for Wylie Laboratories, and Teledyne Brown Engineering Company. Dr. Wellford's research work includes the development of computational techniques for the solution of structural and fluid mechanics problems.

Ghassan Dib graduated from the American University in Beirut with a B.S. in Civil Engineering, then obtained his M.S. and Ph.D. in Structural Engineering from the University of Southern California. He worked with Jack Bryant and Associates in the analysis, design and erection of structural supports in refineries, and with BECHTEL Power Corp. in the study of vibrations in the foundations of nuclear power plants. For five years he was also a lecturer in the University of Southern California teaching courses encompassing dynamics, matrices and Engineering mathematics. His doctoral dissertation dealt with Finite elements for nonlinear Eigenvalue problems with applications in post-buckling behavior of structures and structural dynamics.

Brian Gordon received a B.S. in Civil Engineering from California State University at Los Angeles in 1977, and subsequently served as a design engineer for Robert Englekirk, Inc. where he pursued his interests in microcomputers while developing computer programs for the company's applications. Gordon continues his avid interest in computers with his contribution of the computer graphics package for the SCADA program.

How to design the pyramids for today's budgets.

The Great Pyramid at Giza is said to have taken 400,000 men 20 years to build and required more than 2,000,000 blocks of stone for its construction. The design hours needed to produce this Wonder of the World are incalculable.

All this happened, of course, thousands of years B.C. (Before Cost-accounting).

Your clients, the builders of today, can't afford to be quite so lavish. So they look to you to design them strong, durable buildings that can be put up quickly, using the least expensive materials practicable.

Which can be a big headache. Unless you happen to have a Cromemco microcomputer and SCADA software.

SCADA is a finite-element analysis program designed to reduce engineering time and expenses. It consists of a powerful structural analysis program, including stress and deflection analysis, high-resolution graphics, and dynamics.

SCADA lets you input data in any order convenient to you, and it even has special design-aid programs that automatically check design of structural members. Capacity includes 2- and 3-dimensional truss and frame elements, plane strain, plane stress and plate elements, and an 8-node solid element.

The exciting graphics feature lets you display deflection under loading as well as 3D structures from any angle. There's even a pre-processor function for verification of joint and member locations.

Best of all, SCADA operates on a license basis, so as the programs grow, updates are made available to subscribers.

You may never have to design a Great Pyramid for a pharaoh. But if you did, SCADA could save you a lot of time and money. And it can do the same for your present-day clients.

I'm ready for an eye-opening demonstration of SCADA software and Cromemco microcomputers. Please send me information.

Name_____

Title_____

Firm_____

Address_____

City_____

State/Zip_____

Phone ( )_____

American Computers & Engineers
2001 South Barrington Avenue, Ste. 204
Los Angeles, CA 90025

AMERICAN COMPUTERS & ENGINEERS

Los Angeles: (213) 477-6751
Berkeley: (415) 849-0177
Newport Beach: (714) 851-8700
Calgary, Alberta: (403) 275-5871
Paris, France: 236-94-95

Is it possible you haven't heard of American Computers & Engineers?

Not anymore.

Get to know the company that's been quietly making changes in the business computer marketplace. With a very impressive reputation for service, fair prices, and technical know-how.

Whether you need a network of office systems installed locally or a single diskette rush-shipped to Zurich, all orders receive immediate attention.

- Cromemco's extensive line of microcomputers, accessories and peripherals fully stocked.
- DEC systems configured and integrated.
- Color Graphics.
- Complete selection of software packages plus customizing.

Los Angeles Headquarters: 2001 So. Barrington
Los Angeles, CA 90025 • (213) 477-6751
Berkeley: 2855 Telegraph Ave.
Berkeley, CA 94705 • (415) 849-0177
Newport Beach: 4141 MacArthur Blvd.
Newport Beach, CA 92660 • (714) 851-8700
Canada: 6715 Eighth St. North East
Calgary, Alberta T2E7H7 • (403) 275-5871
France: 55 Rue de Rivoli • 75001 Paris, France
Tel. 236-94-95

AMERICAN COMPUTERS & ENGINEERS

Maxi-performance on Minis and Micros.

If you developed a truly fine piece of software that would back-up data from hard disks and from floppy disks onto other floppy disks, and would do all of this real fast, what would you call it?

We call it . . . FASTBACK

We used to spend hours backing up a full hard disk onto floppies using CPTREE or XFER or CROMIX's BACKUP utilities.

We've even experienced the frustration of teaching a new user how to COPY files from a hard disk to floppies just to have hours worth of work destroyed in a transfer error.

Once we spent over $3,000 for one of those "high speed" tape back-up units just to discover that it was as slow as floppies. We also discovered that the software would not work with CROMIX.

Sometimes, following a power or mechanical failure, we spent hours restoring data from floppies to a hard disk, and then discovered that not everything had been backed up.

Frankly, we got tired of it.

That's why we developed **FASTBACK**

WOW! Have things changed! Now we can . . .

- Effect a 5" DS/DD floppy-to-floppy transfer in 50 seconds, or a similar transfer on 8" disks in 90 seconds.
  FASTBACK is fast.
- Back-up a full, 11-meg CDOS* or CROMIX hard disk in under 12 minutes. On only nine, DS/DD 8" floppies.
  FASTBACK is cost effective.
- Transfer data from one hard disk to another, or transfer from floppy-to-floppy whether CDOS or CROMIX disks.
  FASTBACK is versatile.
- Utilize our existing equipment. By backing up onto floppies we no longer have to invest in expensive peripheral equipment. And floppies are so much more available than hard to find tape cartridges.
  FASTBACK is easy.
- Preserve our data using the automatic installation feature which checks the system and adjusts itself for proper default operations. The simple menu operation ensures successful back-up by anyone. It even checks to be sure the disks are in the proper order.
  FASTBACK is safe.

Estimated Times	Drive Types	Number of disks
12 min.	8" DS/DD	9*
19 min.	8" SS/DD	18
23 min.	8" DS/SD	22
46 min.	8" SS/SD	43
18 min.	5" DS/DD	27**
30 min.	5" SS/DD	54
240 min.	5" DS/SD	60***
500 min.	5" SS/SD	120***

*System Three with Persci 299's, 16 FDC and HDD-11/22.
**System Two with 5" Tandon, 16FDC, and HDD-11/22 or Z2-H with 16FDC.
***Not recommended but supported by FASTBACK.

After all this, what else could we call it?

FASTBACK

. . . A Remarkable System from QUINTEC

Available from **QUINTEC** for $195 (California residents add 6%)
Write or Call: **QUINTEC**
30313 Canwood Street
Suite 15
Agoura, CA 91301
(213) 889-4819

Dealer Inquiries Invited.

*CDOS and CROMIX are registered trademarks of Cromemco, Inc.

tec·tips

TEC TIPS is a regular column aimed at providing hints for keeping systems up and running. It will not attempt to deal with specific engineering applications or non-standard configurations. TEC TIPS is edited by Richard Quinn, owner of QUINTEC, a Southern California Computer service firm.

Increase Time On 16FDC Motor Timer

As I was working with the Quintec Disk Drive Saver for the PerSci 299 disk drive, several problems showed up relating to the time out feature of the 16FDC. The timer is designed to turn off the motors on the disk drives if no access has occurred (either reads or writes) within the last six seconds or so. The problem comes in some application programs that are already in use. The motors time out too soon and cause a "drive not ready" error when accessed. This is less of a problem with the 5" Tandon and Wangco drives as their slower stepping time and fast start DC motors allowed enough time from a dead start.

I first noticed this in using a PerSci 299 and the INIT program. If I took too long to answer all of the questions (over six seconds) the drive motor would time out and I would get a seek error when the initialization began. I then tried it with a 277 drive and often encountered the same problem. If you used the defaults and answered quickly, no problem. You could make it in plenty of time.

But other customers of the drive saver were not able to modify their software, or their program accessed the drive at such intervals that it hit just past the six second mark and had to wait for the drive to come back up to speed slowing overall system performance. So the following modification to the 16FDC is a simple way to increase the time from six to twelve seconds. The clock pulse for the timer comes from IC44, pin 12. There is a clock on the same chip that is half the rate of the one used. To use it, simply remove IC44 from its socket and bend pin 12 up. Reinsert the IC and jumper (using a small wire such as wire wrapping or printed circuit board repair wire) IC44 pin 12 to IC44 pin 15 on the solder side of the board.

If you want more time, (approximately 45 seconds) leave IC44 unchanged and make the following mods to IC6. Remove the IC from its socket and bend over the top (in teepee fashion) pins 3, 4, 5, 6, 12, 13, 14 so that they touch in the middle top of the IC. Leave pin 11 straight up for now. Attach a ¼ watt resistor, 220 ohms to pin 16 and tie the other end to the pins in the middle of the IC (pins 3, 4, 5, 6, 12, 13, and 14). When making solder attachments to the IC, be certain to do it high on the pin so that it can be put back in the socket without a problem. You may want to make the attachments with the IC in the socket, but don't use too much heat or you'll damage the socket. Keep the whole affair low so that it does not interfere with the 5" drive cable. Last, tie pin 11 on IC6, which is also out of the socket, to IC6 pin 5 on the solder side of the board. Go through the small feed-through hole at the base of IC6's socket to get to the solder side of the board.

Now, if you want almost two minutes, make the modifications in both of the above paragraphs and the drive will wait a long time before shutting off. Watch the select lights on your system and see how long the program you are running is taking between accesses, and use the modification that best fits your timing needs. Want to put the board back to original? Simply remove the jumpers from the back, replace the pins on IC44, and replace the IC6 with a new one. The board is now original equipment without any permanent damage.

Simple Printer Test Using BASIC

On many occasions I have tested a printer in the field using a simple program in BASIC. The reason I use BASIC and not the self test switch is for two reasons: 1) this test checks system interface, cables and printer; 2) it is usually much faster than taking apart the printer to look for the self test switch. The test will work for CROMIX or CDOS.

Load BASIC and enter the following program:

```
10 OPEN ;1; "$LP"
20 FOR I = 32 TO 125
30 PRINT CHR$ (I) :
40 PRINT;1; CHR$ (I) ;
50 NEXT I
60 PRINT
70 PRINT;1;
80 GOTO 20
```

Lines 30 and 60 send the output to the console so you can see what is happening. If the printer consistently misses the same characters or substitutes wrong characters, but always the same wrong characters, the problem may be the cable, PRI card, or TU-ART, whichever your system uses. If the problems appear to have a random pattern it may be

Continued on Page 61

what if you want to...

evaluate the risk in your new investment?

plan the financial strategy for a new product line?

analyze the effect of rising inflation on your investments?

know whether you will have to finance your receivables this year?

conduct profitability simulations?

decide whether to lease or buy that new asset?

forecast the cash flows from your investment portfolio?

plan your own financial future?

develop a professional financial presentation —using graphs— for your client or bank?

don't worry! it's easy with planEASe

How often do important "what if" financial questions pop up...and you wish you could get the answers—right away. Now you can with planEASe.

The basic package will enable you to analyze any investment in income-producing real estate. Later, if you wish, you can e-x-p-a-n-d its capabilities with other planEASe models that apply to any number of situations that might crop up. Situations such as...

- Real Estate Partnerships*
- Annual Business Planning
- Long Range Business Planning
- Personal Financial Planning
- Stock & Bond Portfolio Analyses*
- Oil Drilling Ventures
- Equipment Leasing
- Sale & Leaseback Analyses
- Lease vs. Buy Analyses

Designed on Cromemco computers for Cromemco computers, planEASe requires 32K Structured** BASIC, and is compatible with virtually any terminal and printer, CDOS™ or CROMIX.™

*Now Available
**32K Structured BASIC *NOT* Required

Any Questions?

Just call or write us... we're here to help.

Best of all... you can try it FREE for 30 days.

Many Cromemco dealers have added planEASe to their product line, so just ask your dealer for a demonstration. Or, if he doesn't have it in yet, mail us your check for the system price of $295. (California residents please add 6% sales tax; International Customers, please add $15.00 U.S. to cover air mail costs.)

We'll send you a demonstration version of planEASe that you can exercise on your own system —any way you want—for 30 days. No charge. And if planEASe answers your needs as we think it will... well, just slit the seal on the accompanying system diskette and start making your life easy! Otherwise, mail the complete system package (with unopened system diskette intact) back to us within that 30 days and we'll return your license fee—no questions asked. It's that simple.

(We will, of course, need your terminal make and model if it's not a Cromemco, and the size diskettes you need.)

Analytic Associates

4817 Browndeer Lane,
Rolling Hills Estates, CA 90274
(213) 541-0418

CDOS and CROMIX are registered trademarks of Cromemco, Inc.

The Development of a Parallel-Port Adapter (PPA) to Allow the use of parallel ports on SCC and TUART cards as serial ports.

by B. Campbell and P.J. Robertson

Introduction

The TMS 5501 UART chip which is used both on the Cromemco single-card computer (SCC) and the digital interface (TUART) provides a serial and a parallel port. Many applications of microcomputer systems involve the use of serial links to other devices usually using RS232 interfaces e.g. to hard-copy devices or remote systems. Users of Cromemco systems have used TUART cards for these connections and we have found cases of redundancy with regard to parallel ports coupled with a desire for more serial ports. To remedy this situation, the microprocessor group in the Computing Laboratory (at the University of St. Andrews, Scotland) has designed and implemented a device which is relatively simple and inexpensive to build. This article describes the device — a Parallel Port Adapter, hereafter referred to as the PPA.

Unit Description

A diagram of the PPA is given in Figure 1.

This is wired for connection to the SCC card; for connection to the parallel port on a TUART card, the cross-connections shown in Figure 2 are required. Figure 2 also gives a component list for the symbols referred to in Figure 1.

The adapter allows serial devices to connect to the parallel ports with the full interrupt facilities normally available to the parallel device being made available to the serial device. There is a restriction in that only seven bits in each port are available for data. The unit may be self-powered so that it can be used with systems having minimal power supply facilities. Alternatively, where adequate facilities are available, it may be powered from the system itself. Connections are to a serial device RS232 port, a parallel interface header connector and optional mains supply.

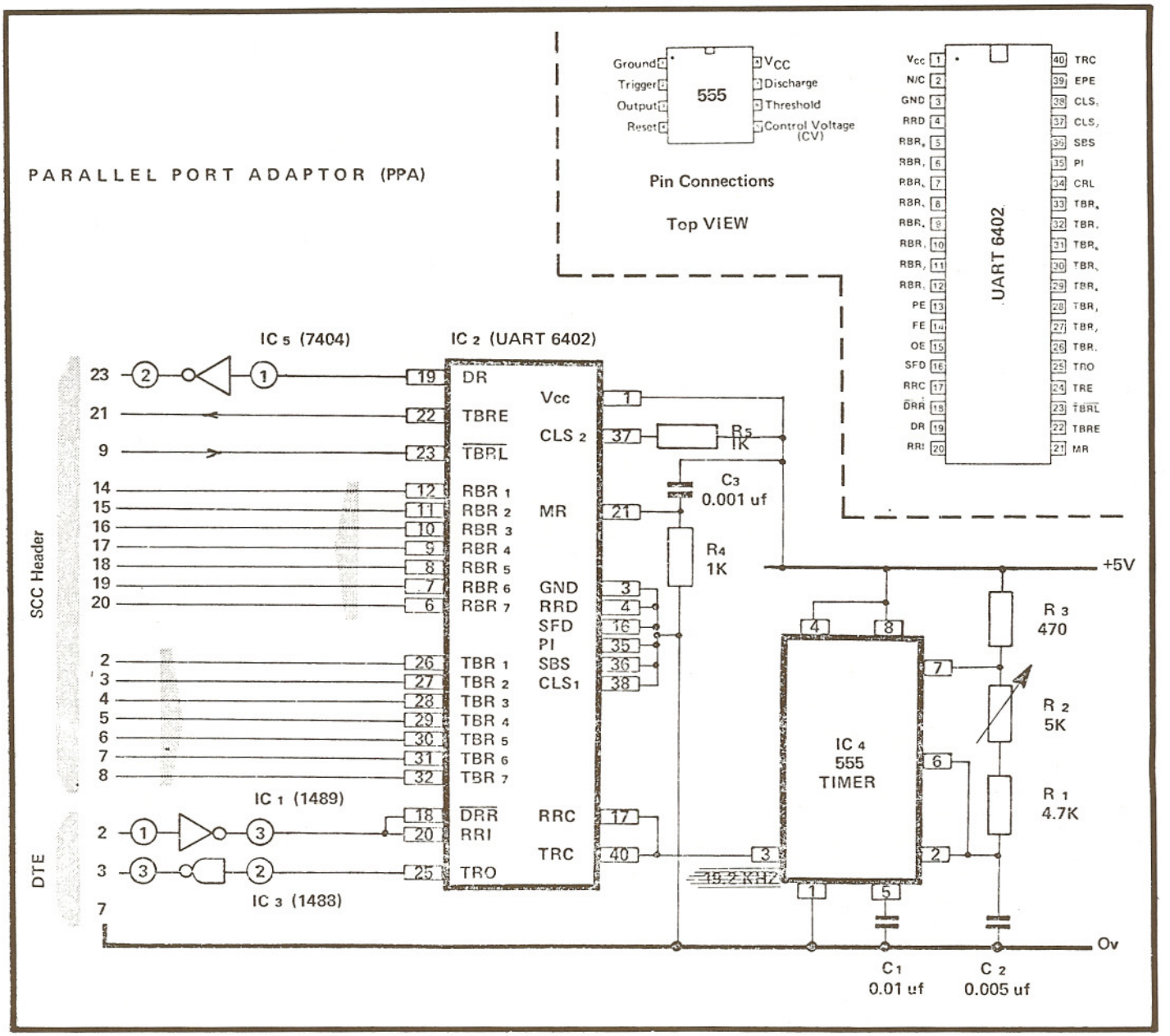
Circuit Description

The heart of the unit is an .Intersil IM6402 universal asynchronous receiver/transmitter, chosen from the wide selection of such devices by virtue of its simple power supply requirements and its TTL compatible input/output capability. RS232 serial data from the serial device is converted from RS232 levels to TTL levels by IC1, a 1489 line receiver. The converted signal feeds the receiver register input (RRI) and also the data received reset (/DRR) input of the 6402 UART effectively producing a 7-bit parallel word on the receiver buffer register outputs (RBR1-7) and an interrupt pulse on the data received output (DR). The 7-bit data word (which is effectively the parallel version of the serial received data), together with the DR interrupt pulse, form the 8-bit input to the parallel port.

Parallel data from the SCC port feeds the transmitter buffer register inputs (TBR1-7) directly, and a strobe pulse from the SCC applied to the transmitter buffer register load input (/TBRL) initiates serial transfer from the transmitter register output (TRO) of the 6402. The serial data thus obtained is converted from TTL to RS232 levels by IC3, a 1488, for output to the serial device. Handshaking is achieved on output to the serial device by using the transmitter buffer register empty (TBRE) output of the 6402 to cause an interrupt on the SCC/TUART. The serial device can thus signal its readiness to accept a new character from the interface.

A 555 timer in astable mode generates a 19.2Khz TTL square wave for serial transmit and receive baud rate clock purposes, giving a serial baud rate of 1200. The serial baud rate is hardware-adjustable to meet the particular requirements of the applications. Serial character length, parity, number of stop bits are also selectable using the CLS and PE inputs of the 6402. Normally, these are set to give 7 bits, no parity.

Continued next page



Software

The programming of the parallel port with the PPA attached for both the TUART and the SCC cards follows, mutatis mutandis; the design used to service the serial port. One significant difference is that only seven bits are available in both the input and the output port for data; in both, the most significant bit is used for some function. The bit in the input port is used as an interrupt indicator while the bit in the output port is used as a strobe bit. The interrupts used are the SENS line for input and the PI7 line for output, thereby requiring different addresses for interrupt service and different masks in the interrupt register. (Note that the SENS line is referred to as the INT line on the SCC card.) The input interrupt indicates that a character has been received in the parallel input port while the output interrupt indicates that the output buffer in the PPA has been emptied and is available to accept further data.

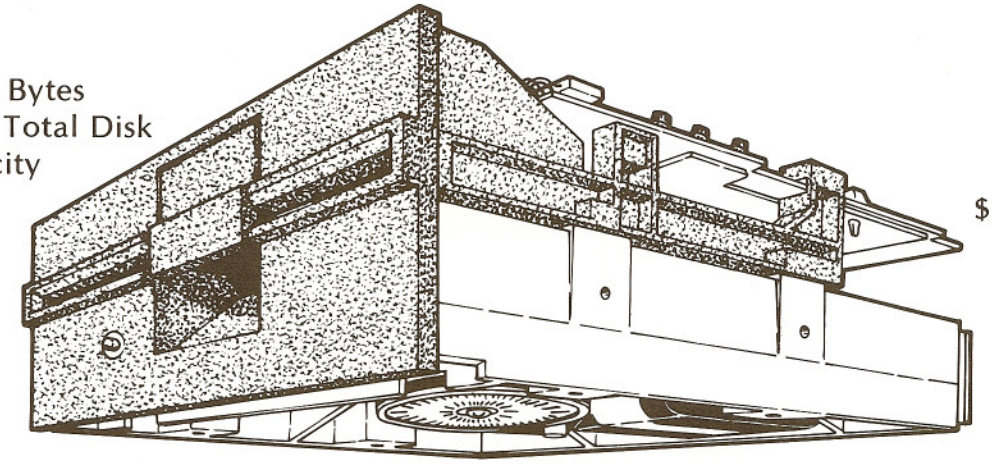
On output, it is necessary to use the most significant bit of the parallel output port as a strobe bit. This should be kept high when the port is inactive. When output is ready, it should be brought low and then returned high to effect a strobe pulse.

The following listing is a program which allows the micro to behave as a transparent virtual terminal to some remote system. The line to the remote computer is on the serial port while the terminal is on the parallel port of the same device.

Continued on Page 52

EXPAND YOUR SYSTEM'S FLOPPY DISK STORAGE . . . .

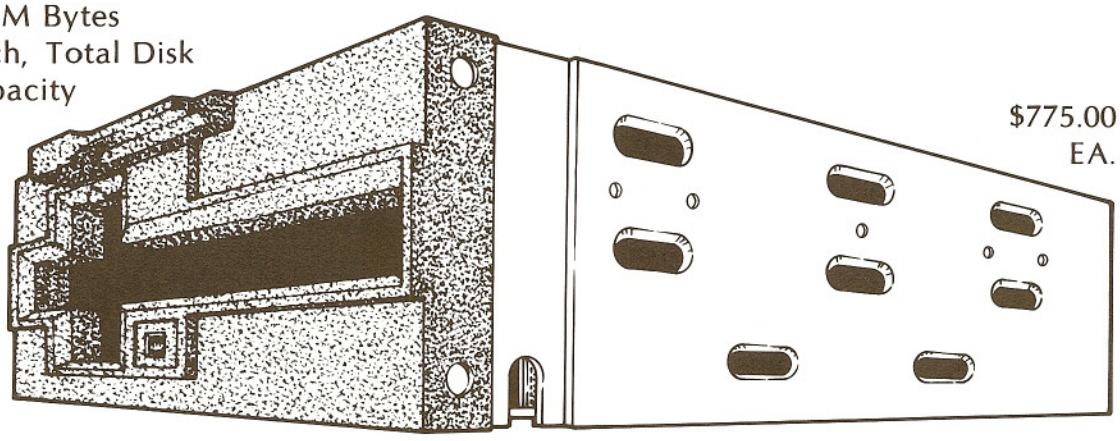
. . . . 790 K Bytes Each, Total Disk Capacity



$575.00 EA.

5 Inches

. . . . 1.2 M Bytes Each, Total Disk Capacity



$775.00 EA.

8 Inches

5-Inch Drives

- Tandon Quality You Can Depend On
- Directly Replaces Existing Wanco and Tandon Drives
- Operates Under CDOS, Cromix, CP/M (16FDC Required)
- 96 Tracks per Inch — 80-Track Format
- Will Read Current 40-Track Diskettes
- 50% Faster Access Time

8-Inch Drives

- New! Half-Width Tandon Drives
  2-Tandon Drives Are Same Width of One Persci or Shugart
- Operates Under CDOS, Cromix, CP/M (16FDC Req'd)
- Super Backup Choice for Hard Disk Systems
- Requires Separate Power Supply
- Requires External Mounting
- Single Drive Cabinet With Power Supply — $225
- Four Drive Cabinet With Power Supply $400
- Do-It-Yourself Power Supply $150

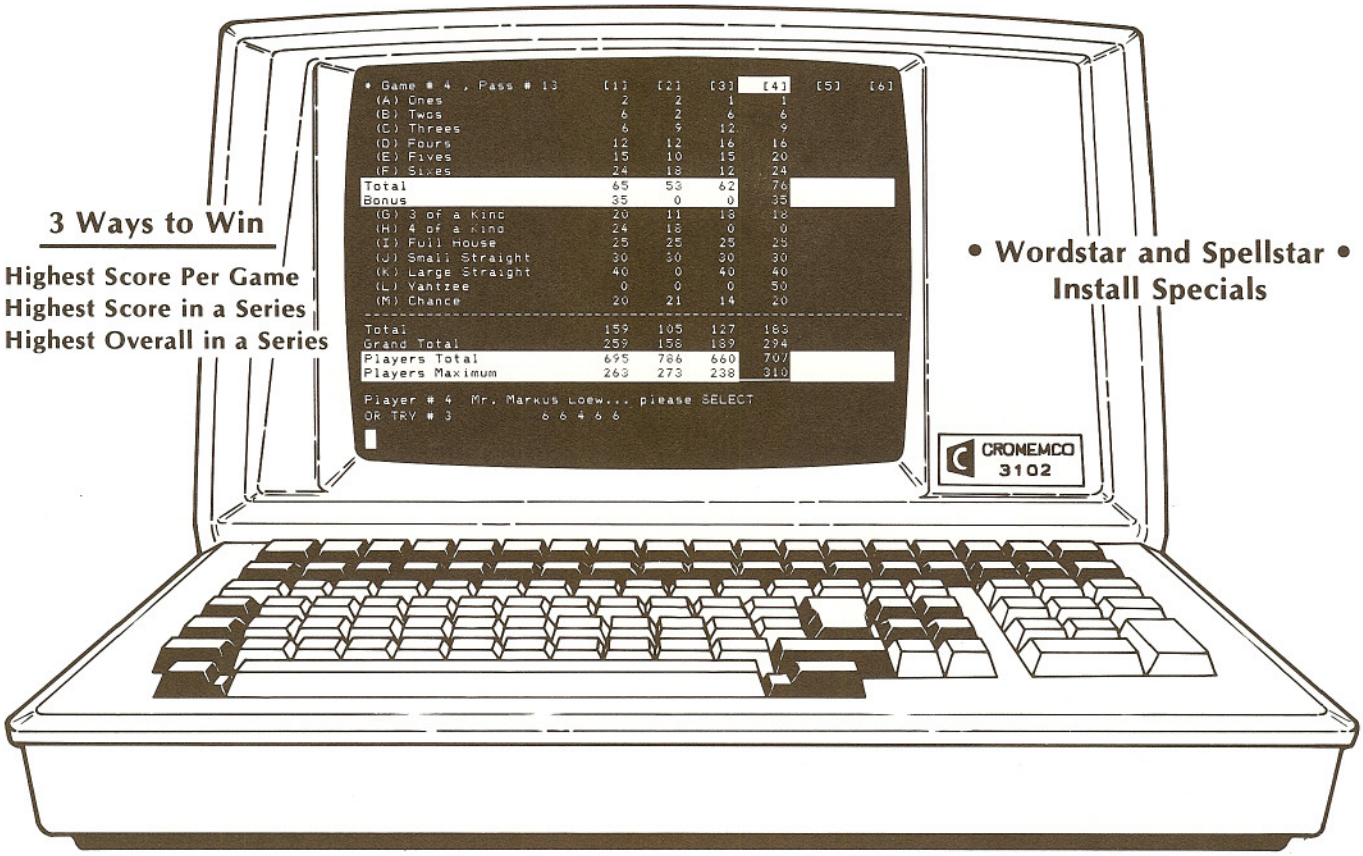
Installation Software

With Purchase of 2 or More Drives — (CDOS and Cromix — $50.00 each) Regular (CDOS and Cromix $100, Both $150)

DATA-COMM

7652 SLATER AVENUE
HUNTINGTON BEACH, CALIF. 92647

Yahtzee FOR THE ADVENTURESOME 1-9 PLAYERS



3 Ways to Win

Highest Score Per Game
Highest Score in a Series
Highest Overall in a Series

• Wordstar and Spellstar •
Install Specials

- Wordstar 3102 Utilizing 33 Special Function Keys (Template Included)
- Wordstar Soroc IQ-140 Special Function Keys
- Wordstar ADM-42 Utilizing Special Function Keys (Template Included)
- Wordstar All Other Terminals Supported by Wordstar

} $125 Each Specify **CDOS** or **Cromix**

- Spellstar — Run Under Cromix Operating System $49.00
- Fast Copy — Persci/Tandon/Shugart, CDOS, Cromix, CP/M $49.00
- Yahtzee — (Specify -3102, Soroc, ADM-42, Intertube II) $39.00

Orders Only 1-800-854-0561, Ext. 914

FOR INFORMATION OR SUPPORT: CALL (714) 842-7515

VISA master charge

DATA-COMM

7652 SLATER AVENUE
HUNTINGTON BEACH, CALIF. 92647

CALIF. RESIDENTS ADD 6%

Computer Controlled Automated Materials Handling for Manufacturing

by Dr. Roger C. Vergin

Conex Electro Systems Inc. of Bellingham, WA and Ideal Handling Systems Inc. of Montreal, Canada recently combined to develop and install a highly automated materials handling system for a clothing manufacturing firm, Sportscaster, Inc. in Bellingham, Washington.

The system uses an overhead conveyer with 200 lb. capacity carriers to move work in process between work stations. System control uses a Cromemco microcomputer. The CPU board is the Cromemco ZPU microprocessor based on the Zilog Z-80. Several other plug-in circuit boards are included in a Cromemco Z-2 microcomputer cabinet. The CPU communicates with control boxes containing Z-80 microprocessors located at forty individual work stations.

Sewing Manufacturing Production Processes

PROGRESSIVE BUNDLE SYSTEM. In the clothing manufacturing industry, the predominant production process for the past fifty years has been the progressive bundle system. In this system, bundles of cut goods are delivered to each sewing machine operator (who is typically responsible for a small portion of the total sewing on a garment). The operator unties the bundle, reads the instruction sheets, lays out the pieces of material in the work area, picks up and positions the part to be worked on. Then the actual sewing is done, the completed part put aside, and the next part picked up. When the whole bundle of work is completed, the batch is again put together and retied. A materials handling person is then called to pick up the bundle and deliver it to the next work station.

While the bundle system does allow for the economies of specialization of work, it has several disadvantages. In-process inventories are high and long throughput times are required for order completion. There is a large portion of handling time compared to productive time because of the large amount of handling both between work stations and within each work station. There is also a high level of clerical work, lack of control of in-process inventory, and a large floor space requirement.

UNIT PRODUCTION SYSTEM. The automated materials handling system developed by Conex Electro Systems and Ideal Handling Systems allows the use of a unit production system. This system completely eliminates the need to combine parts into bundles and allows the garments to flow through the factory one at a time.

The unit production system employs the following procedures. The cut goods are laid out on a preparation assembly table, where all components for a single garment are loaded on a single carrier. The carrier is then input from the staging area into the system and to the work station where the first operation is to be performed. The operator performs the designated sewing and disposes of each completed garment by pressing a "Send" button on the machine. The completed carrier proceeds to a predetermined work station where the next operation in the work sequence will be performed and the next carrier will automatically move into the pickup position. This cycle is then repeated throughout the remainder of the production process until completion of a finished unit.

The computer memory system automatically keeps track of each numbered carrier as it progresses through the system. It is possible to intermix multiple orders flowing through the factory.

Besides controlling the production flow, the computerized system also provides for management information and control. Information reports such as cut reports, hourly production, inventory, operation sequence, station status, and work in process are instantly available on a CRT display and on a hard copy printer. This information is also available anywhere in the world via modem.

The advantages of the unit production system over the bundle system are: low in-process inventory, drastic reduction of handling time, total computerized control of work in process, reduced clerical work, elimination of bundle tickets and reduced floor space requirement. Specific figures for cost savings for Sportcaster Inc. are shown later.

Automated Materials Handling System

The automated materials handling system has three major functional parts: (1) the Mechanical System; (2) the Work Stations; and (3) the Control System.

THE MECHANICAL SYSTEM. The main element of the mechanical system is the overhead loop. It is an aluminum extrusion with a tubular rail directly beneath it, all suspended from a steel supporting structure. The shape of the loop is flexible and designed to follow the basic path of work flow in an individual plant.

A chain rolls along inside the extrusion on nylon wheels. The chain is driven by a motor and sprocket mounted on the structure. Each unit of work is hung on a carrier, which has a roller at the top. The carriers move through the system by rolling along the overhead rail, propelled by moving pushers hung from the chain.

Continued next page

THE WORK STATIONS. Carriers proceed through the system by moving from one work station to another in a programmed sequence, via the chain. A station is somewhat similar to a railroad siding. It has an overhead mounted tubular rail. A carrier enters a station from the chain when an air cylinder pivots a short section of the main rail over to meet one end of the station's rail. A pusher moves the carrier off onto the station rail, where it rolls by gravity down a slight incline into the station.

Each station has a control box suspended in front of the operator, which houses the station's electronic circuitry and the operator control panel. When the operator completes a unit, the "Send" button is pushed. This causes an air cylinder to lift the completed carrier on its rail to a slightly elevated staging position near the main rail. From there, another air cylinder pivots the station rail over to meet the main rail and simultaneously kicks the carrier out onto the chain. The carrier then proceeds to its next destination.

In addition, each station control box allows the operator to send a unit directly to a repair station if he detects a defect.

Each box contains Z-80 microprocessor based circuitry to accept commands and data from the control system, drive the solenoid air valves and displays, and transmit switch data to the control system. Information displayed to the operator at each work station includes the time, the operator's ID number, the current cut or batch number, the operation number, and a count of the number of completed units.

THE CONTROL SYSTEM. The con trol console is a desk type unit housing the various pieces of electronic equipment necessary to program and control the overall system operation.

The heart of the control system is the Cromemco Z2 microcomputer incorporating 32 Kbytes of 200 ns static RAM. The program is stored on two 16 KPR PROM boards, and uses about 22 Kbytes of 2708's. The TUART interface boards communicate with a standard CRT terminal, a Centronics 80 column printer, two electrostatic strip printers, and the system interface board. This board provides a one-second time base. drive for an LED diagnostic indicator panel, and optically isolated current loop interface to the work station control boxes. Due to the real time nature of the system, all of these peripheral devices utilize vectored interrupts.

Software development and hardware/software de-bugging was accomplished with a separate Cromemco Z2-D microcomputer in conjunction with the Cromemco macro-assembler and Debug software. A Systron-Donner micro-processor analyzer proved invaluable in eliminating tricky interrupt related bugs. 2708 EPROMS were blown with the Cromemco Bytesaver board.

The video terminal, or CRT and keyboard device, is the means of system control and monitoring. It is used to establish operation breakdown sequences for each cut, to assign employee ID numbers to the stations, to examine the status and carrier inventories of the stations, to extract each employee's daily production figures from the system, and to perform various other system control functions.

The printers are used to print the employee production reports at appropriate intervals, to print a running list of all carriers entered by the loading station, and to print carrier history reports to allow the tracing of sewing errors to individual operators.

System Savings

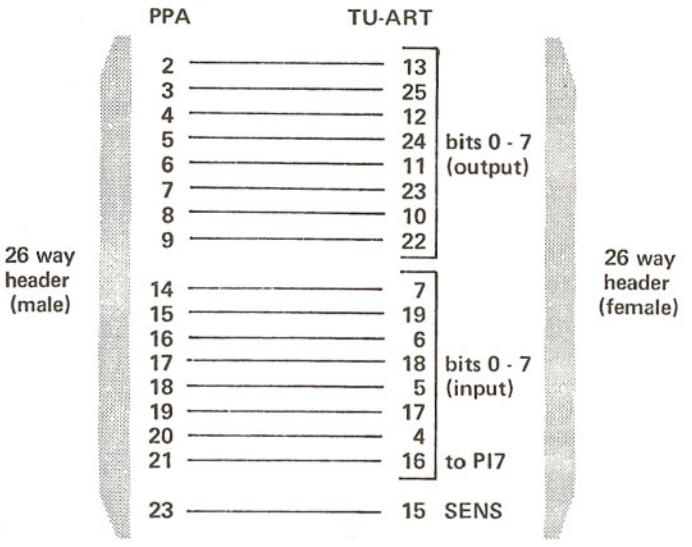
As noted, the unit production system has many economic advantages in more effectively utilizing labor and in reducing inventory and floor space. For the Sportscaster, Inc. operation, it was found that the average throughput time for order completion was reduced from 30 days all the way down to 2 days, substantially reducing inprocess inventory and also enabling the firm to provide much better service and delivery times. Because of the elimination of stacks of bundles, floor space requirements were halved. With much reduced handling at the work place, direct productivity was increased an estimated 30% and even larger improvements occurred

Continued on Page 62

The Development of a Parallel-Port Adapter (PPA) to Allow the use of parallel ports on SCC and TUART cards as serial ports.

Continued from page 47

Adaptor for use with PPA and TU-ART card



Component List

IC 1 = 1489 line receiver
IC 2 = 6402 UART
IC 3 = 1488 line driver
IC 4 = 555 timer
IC 5 = 7404 hex invertor

C1 = 0.01 uf
C2 = 0.005 uf
C3 = 0.001 uf

R1 = 4.7 K
R2 = 5 K
R3 = 470
R4, R5 = 1 K

Figure 2


```
;   This program uses device A on a TUART board to
;  communicate with the computer. A terminal goes on the
;  parallel port of the device which is at 20H while
;  the computer line goes on the serial port. The device B
;  which is suppressed is at 60H.
;   On input, the interrupt from the parallel port
;  appears in the SENS line. On output, the MSB (bit 7)
;  in the parallel port is used as a strobe bit for the
;  PPA. This is normally held high but is sent low and
;  then high again when a byte is ready for output.
;
;   Set up constants and initialise
;
STATUS      EQU     20H             ; status register of port
BAUDRT      EQU     STATUS          ; baud rate register
DATA        EQU     STATUS+1            ; serial data register
COMM        EQU     STATUS+2            ; command register
MSK EQU     STATUS+3            ; interrupt mask
PPORT       EQU     STATUS+4            ; parallel data port
BDEV        EQU     60H                 ; address of device B on TUART
BMSK        EQU     BDEV+3
;
GETOUT      EQU     5               ; ASCII code of character which causes
                                    ;exit to monitor - control-E here
STACK       EQU     23FFH               ; stack located at top of RAM
;
TBE EQU     80H                     ; transmit buffer empty mask
RDA EQU     40H                     ; receive data available mask
;
;
INIT:
    ORG     100H
    LD      SP,STACK                ; initialise stack
    LD      A,88H                   ; set baud rate of 1200
    OUT     BAUDRT,A
    LD      A,09H                   ; reset and interrupt enable
    OUT     COMM,A                  ; send to command register
    LD      A,0                     ; disable activity on device B
    OUT     BMSK,A
    LD      A,14H                   ; interrupt mask
    OUT     MSK,A
    IM      2                       ; set interrupt mode 2
    LD      A,2                     ; upper byte of int. address
    LD      I,A                     ; put into int.register
    LD      A,80H                   ; set bit 8 in accumulator
    OUT     PPORT,A                 ; send to parallel port (bit 8
                                    ;to be used as strobe bit)
    EI                              ; enable interrupts
    JP      LOOP
;
LOOP:
    JP      LOOP                    ;  sit here waiting for input
;
VAXIN:
    IN      A,DATA                  ; read in data
    AND     7FH                     ; reduce to seven bits
;
VDUOUT:                             ; now send to terminal
    OUT     PPORT,A                 ; send to parallel port which
                                    ;will also bring strobe bit low
    OR      80H                     ; reset strobe bit



    OUT     PPORT,A                 ; send byte again
    EI                              ; enable interrupts again
    RET
;
VDUIN:
;
    IN      A,PPORT                 ; read data
    AND     7FH                     ; reduce to seven bits
    CP      GETOUT                  ; check for ^E
    JP      Z,FIN
;
VAXOUT:                             ; now send to remote host
    PUSH    AF                      ; save character
    IN      A,STATUS                ; check status of serial port
    AND     TBE                     ; is transmit buffer empty
    JR      Z,VAXOUT                ; if unready, wait for it
    POP     AF                      ; restore character
    OUT     DATA,A                  ; send data
    EI                              ; enable interrupts again
    RET
;
FIN:
    JP      0H                      ; back to monitor
;
    ORG     224H                    ; interrupt vector for parallel port
    DW      VDUIN
;
    ORG     228H                    ; interrupt vector for serial port
    DW      VAXIN
;
    END
```

About The Authors

B. Campbell and P.J. Robertson are with the Computing Laboratory at the University of St. Andrews, North Haugh, St. Andrews, Fife KY16 9SX, United Kingdom.

Powerful... because it's Relational

The new RL-1 Database® from ABW Corporation gives you the power of a sophisticated relational database management system for your Cromemco* or CP/M* computer.

Why a Data Base Management System?

Whether your business is accounting, engineering, or production your main use of a computer is to maintain and process information. A Data Base Management System allows that information to be maintained independent of a particular application. Different programs can easily process the same data without modification or data re-entry.

Why Relational?

The relational model presents data in simple, easy to use tables. The simplicity and power of this tabular form allows the user to answer complicated questions by learning only three operations: Selection, Projection, and Join.

The RL-1 System Includes:

Relational Data Base
A complete implementation of a relational data base.

Query Language
An interactive high level query language, similar to SQL. This query language use simple English phrases for the operations selection, projection, and join. Thus, even the novice user can easily ask sophisticated questions.

Relational Editor
A screen oriented editor to create, delete, and update your data files.

Program Interface
Allows you to access the data base through high level language programs.

File Transfer Programs
Utility programs to assist the user in transferring to/from existing programs and other machines.

These five packages allow you to create and maintain a sophisticated data base system for many diverse applications.

Application Packs

To assist the user several application packages will soon be available for use with the RL-1 system.

Report Generator
Automatically formats data from multiple files for report generation.

Input Processor
Allows user to input data via custom designed "forms" for easy operator entry.

General Ledger
Includes General Journal, Posting to Accounts, Trial Balance, Balance Sheet, and Income Statement.

Accounts Receivable
Generates invoices and statements. Handles aging of accounts receivable.

Accounts Payable
Handles checks, check register, vouchers, and vendor files.

Payroll
Processes 940, 941, and W-2 forms. Maintains employee files and payroll register.

Inventory and Production Control
Maintains inventory status and current price lists. Generates reorder report, bill of materials, etc.

Executive Planner
Assists in the generation of business plans and projections. Allows for optimization of key parameters.

Graphics Processor
Allows data to be displayed graphically. Compatible drivers for Cromemco SDI, Tektronix* 4010, Houston Instruments DMP* plotters, and many others.

RL-1 is available for Cromix, CDOS, and CP/M systems for only $495.† Application Packs at additional costs.

RL-1® RELATIONAL DATA BASE

For further information contact:
ABW Corporation
P.O. Box M1047
Ann Arbor, MI 48106
(313) 971-9364

ABW CORPORATION

Continued from page 16

The Development of a New Family of Computer Products

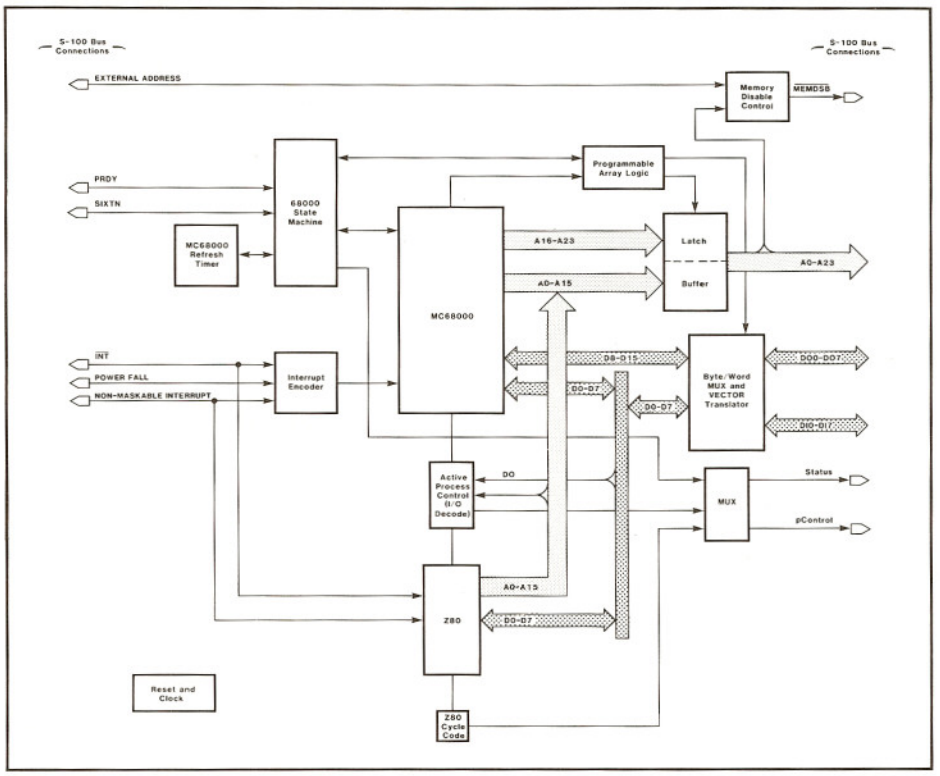


FIGURE 3
Block Diagram, Double Processor Unit

A block diagram of the processor is shown in Figure 3.

The DPU employs software control to switch between the two on-board processors by decoding an I/O command and using active processor control. Pseudo-bank switching through the 68000 allows the Z-80A to address the full sixteen-megabyte address range of the 68000. An eight-bit latch carries the value of the upper eight bits of the twenty-four-bit address of the 68000 and determines the page in which any other processor or sixteen-bit address device in the system is operating.

A finite state machine monitors the 68000 timing cycles and produces the appropriate S-100 signals for correct IEEE-696 operation. An interrupt decoder was developed for the 68000 in order to maintain continuity with the Z-80. There are four levels of interrupt in the DPU: maskable, non-maskable, bus, and power-fail interrupts.

The processor board was designed to operate with either existing eight-bit-wide memories, or with new sixteen-bit-wide memories. If byte-width memories are used, the DPU will fetch two bytes consecutively and concatenate them into one word in order to perform word-width operations. The DPU board even generates simulated Z-80 op-code fetch machine cycles when in the 68000 mode to ensure compatibility with the refresh mode of existing memory boards. Special use of the MEMDSB (Memory Disable) signal allows the mixing of new sixteen-bit memories with existing eight-bit, sixty-four-kilobyte address-space memories. New DMA devices can also make use of this MEMDSB circuit. This is especially useful when loading data between hard disk and memory or color graphics frame buffers. The 68000 also has sixty-four kilobytes of address locations devoted to Input/Output device addresses.

Continued next page

CROMEMCO BUYERS' CO-OP

Join Today

Increase your purchasing power . . .

Gain 24-hour access to consumer product information . . .

Exercise your consumer influence on product development and warranties . . .

The ***CROMEMCO BUYERS' CO-OP*** *(CBC)* is an organization for Cromemco product buyers who wish to derive the benefits of group buying power and organized consumer influence, as well as access to the pooled information resources of Cromemco users around the world.

Open up a world of Cromemco buyer services for only $15:

- One-year replacement warranty on all computer boards purchased through *CBC*
- 24-hour Electronic Bulletin Board
- Discount on books, magazines, manuals

FEATURE PRODUCT SPECIALS OF THE MONTH

Cromemco 68000 DPU

Dual Processor Unit with error-correcting RAM

256K Special

When You Buy:

68000 DPU	$ 995
MCU*	$ 495
256K board	$1995
Total	$3485

Members Also Receive

68000 CROMIX**

FEATURE PRODUCT LIST
(for CBC members only)

68000 DPU (Dual Processor Unit)	$ 995
68000 Compatible Cromix**	$ 595
MCU (Memory Control Unit)*	$ 495
256K Memory Board	$1995
512K Memory Board	$2995

512K Special

When You Buy:

68000 DPU	$ 995
512K board	$2995
Total	$3990

Members Also Receive

MCU*

68000 CROMIX**

To join the ***CROMEMCO BUYERS' CO-OP***, send your name, address, and telephone number today along with your $15 Membership Fee to:

CROMEMCO BUYERS' CO-OP

18007 Sorrel Ridge Drive
Spring, Texas 77373
TOLL FREE 1-800-231-4642
or 1-713-957-1968 (in Texas)

Readers invited to mail comments and suggestions

* The MCU board is needed for the error-correcting memory, however one MCU controls up to eight memory boards.

** The 68000 Compatible Cromix is necessary because the previous Z-80 compatible version will not work with the 68000.

CROMIX is a trademark of Cromemco, Inc.

A Review Of PlanEASe

Continued from Page 26

tions in risk analysis. (Monte Carlo is to roll the die and count the number of times a one or two or five, etc. comes up.) But in a real life situation, there is not usually equal chance for all occurrences as in dice. Therefore, the model can favor a condition. Using the sensitivity analysis feature of the system you can test for the sensitivity of one of the assumptions in the model, say a floating interest rate.

I look forward to using the system and to the new modules that are coming. I can see many uses for this system and know that Analytic Associates will continue to support it in the fine manner they have started. The software reflects the experience and natural talents of Robert Feakins, its architect. With his past experience as Chief Financial Officer for a major division of Northrop Corporation and Stanford Business School degree, he is well qualified for developing such models. He has sold his services to a wide variety of firms for just such analysis and now you can have the system on your own computer. At $295.00 it could save you many times that amount on a bad investment.

New Family of Computer Products

Continued from page 54

Compatibility with the widely recognized IEEE-696/S-100 standard bus allows the DPU a wide range of expandability with not only the Cromemco family of peripherals such as Hard and Floppy Disk Controllers, Color Graphics, and Analog Converter boards, but with a wide range of boards supplied by independent vendors as well.

New Memory

Along with the new high performance processor board, new memory boards making use of high-technology components were designed to form a family of products that can be integrated into a high-performance computer system. Because of the larger addressing space of the 68000 and the sixteen-and thirty-two-bit data words the 68000 can handle, larger memory storage units are permissible than were addressable by eight-bit microprocessors. Luckily, with the advent of larger and more densely packed memory chips, in particular the 64K RAM, it was possible to design memory boards with up to 512 kilobytes of storage space for use with the DPU family system.

In a new approach to the design of small computer systems, the memory-controller circuitry was designed as a separate product from the actual memory storage cards. This was done for two reasons. First, there is no need to duplicate the cost and heat dissipation of controllers on every card when one controller circuit can control many memory cards. Second, removing the controller circuitry from the memory storage cards allows more room for memory chips on each card, increasing the maximum amount of memory storage per card. This memory system approach is illustrated in Figure 4.

The basic memory storage cards were designed to be produced in two sizes: 256 kilobytes and 512 kilobytes. (When 256K RAM chips are

Continued Next Page

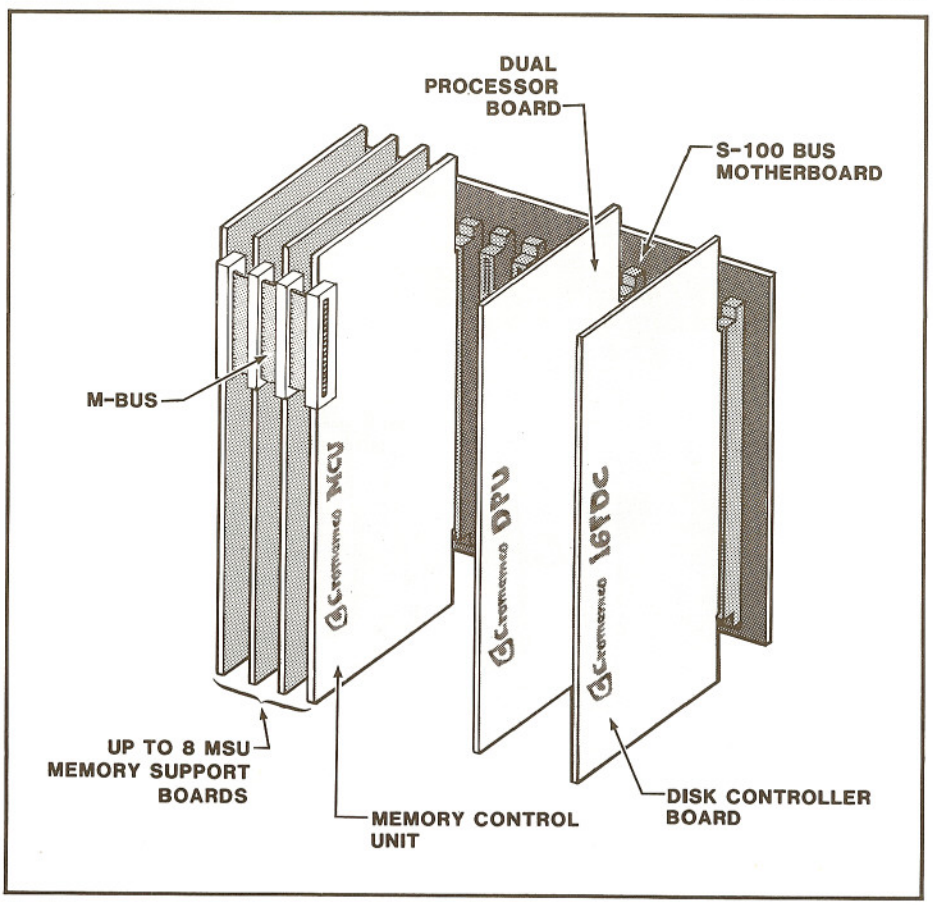


FIGURE 4 Block Diagram of DPU, MCU, and MSU cards in a system application

available in production quantities, a 2048 kilbyte memory card will be offered as well.) In addition, error correction was made a standard feature of each card. With sixteen- or thirty-two-bit-long data blocks and large, densely packed memory-storage units, some form of error detection and correction is necessary to provide smooth, trouble-free operation of computer software. Random errors may become commonplace in future memory systems as only 100,000 electrons are used to store each "1" or "0." Alpha-particle emissions and cosmic rays will contribute to these "normal" errors. In addition to sixteen-bit data words on each board, an additional six bits of memory storage is added to each word to allow a modified Hamming code detection/correction algorithm to detect up to two bit errors per word, and to correct one erroneous bit per word. In addition, the error correction/detection circuitry can be checked (even if all the memory chips are good), by a diagnostic ROM program resident on each memory storage unit which allows the generation of deliberate errors.

In addition to utilizing fast, 150-nanosecond-access-time, 64K RAMS, the Memory Storage Units provide for data retention on system reset. Memory can also be refreshed during DMA operations if it is not being accessed.

Each group of up to eight Memory Storage Units requires one Memory Control Unit. At present up to four megabytes of memory can be controlled by a single MCU.

The Memory Control Unit supports either byte- or word-width memory operations. For use with the error detection/correction Memory Storage Units, there is an error logging feature on the Memory Control Unit. This feature stores the location of errors encountered, identifying which Memory Storage Unit generated the error and which particular RAM chip on the MSU had the error. This provides a very valuable diagnostic and preventive maintenance tool for large systems, as a user can be aware of degradation in performance over time which might indicate an impending failure of a memory unit.

The Memory Control Unit also handles the timing functions for the Memory Storage cards, including the generation of two refresh cycles for every simulated M1 (Z-80 instruction fetch/refresh) cycle in the 68000 mode of operation, as well as firmware-controlled RAM timing. The RAM timing can thus be reprogrammed to compensate for faster or slower access times in different RAM chips in anticipation of the coming of 256K RAMS, which will allow two megabytes of memory per Memory Storage Unit or the full sixteen megabytes of memory with a single Memory Control Unit.

Software

While the hardware development was taking place, equal effort was put into providing sufficient software support so that the final product would be a complete system rather than just a collection of high-level circuit boards. Towards this end, considerable effort was spent on upgrading the widely acclaimed CROMIX operating system to run on the 68000 processor. Software is traditionally fine tuned through years of heavy use in the field. CROMIX has the advantage of already having been widely used and thoroughly shaken out on microcomputer systems. The CROMIX operating system, while quite similar to the well known Bell Laboratories UNIX operating system, was developed entirely at Cromemco to provide multi-user, multi-tasking operation of the Z-80A.

CROMIX is superior to UNIX in several respects. First, a higher degree of "user friendliness" has been implemented in CROMIX, with command names having been given plain English and understandable names wherever possible. File security has also been improved in CROMIX in

Continued next page

CROMEMCO Z2-D — 64K

Complete system. Dual SSDD 8" Persci drives; Dual SSSD 5¼" drives; ADM-3A Terminal; Cromemco 3355A (NEC Spinwriter) bi-directional thimble printer with 132 columns. CDOS. 16FCD controller (compatible with CROMIX). Used six months. Complete system, $8,000; system without printer, $4,400. Dr. Stone, (314) 821-3375. P.O. Box 16130, St. Louis, MO 63105.

New Family of Computer Products

Continued from page 57

order to prevent unauthorized access of files "owned" by each user. Within the CROMIX operating system resides a simulator for the single-user CDOS (CP/M-like) operating system that allows a wide variety of eight-bit software to run on multi-user eight bit machines as well as on the 68000 based system. (See Tom McCalmont's article "The CROMIX OPERATING SYSTEM..." in I/O News Volume One, Number One for more details on the operating system.)

The eight-bit version of CROMIX provided for up to six parallel banks of 64K of RAM for user programs. In the 68000 implementation, the 16-megabyte addressing range is allocated in 64K pages as shown in Figure 5, with the bottom two pages devoted to the CROMIX operating system, and the remainder of the memory allocated in 64K pages.

This currently allows up to 18 users to perform concurrent tasks on the processor. Existing Z-80 application programs can be run in any 64K page, and 68000 programs can be allocated memory in 64K segments up to the total amount of memory installed in the system.

Once the operating system had been developed, the search for the

Continued next page

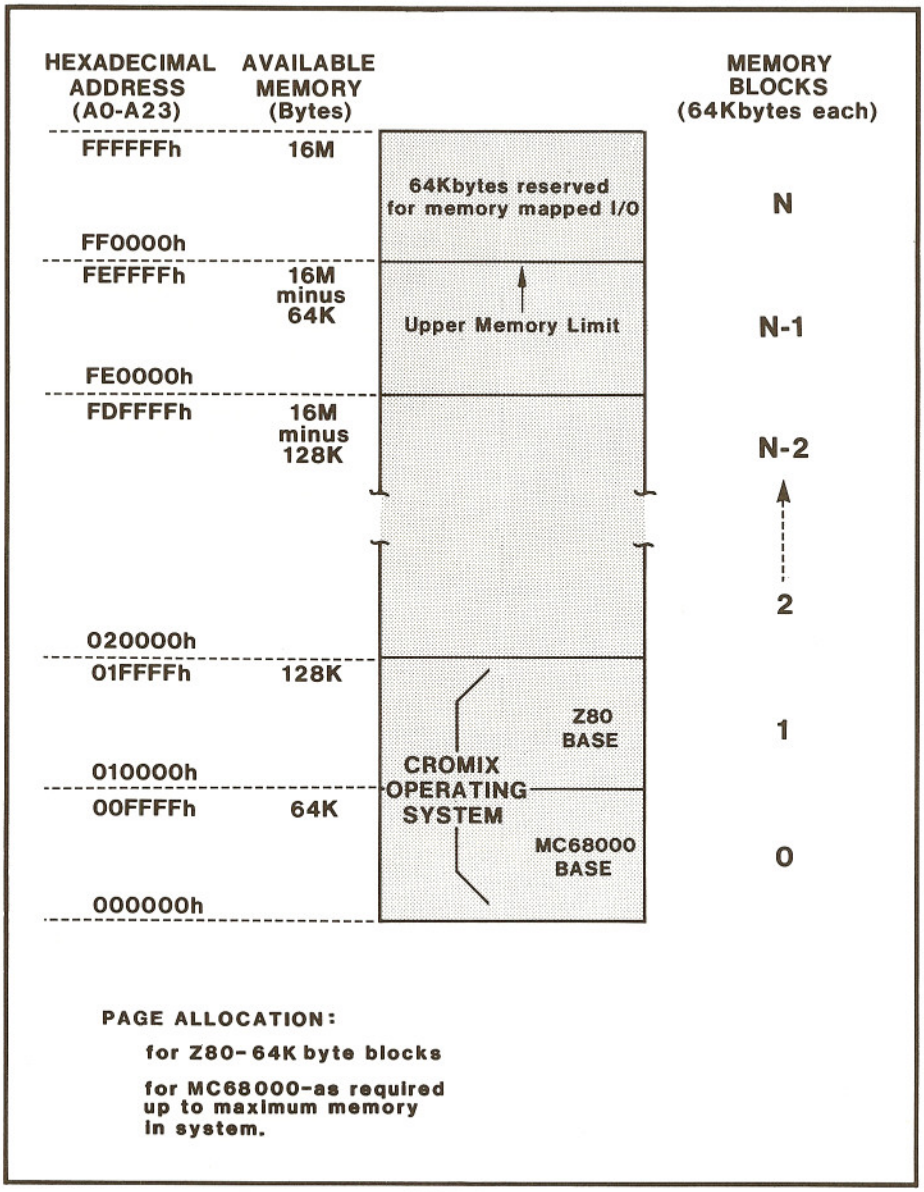


FIGURE 5
CROMIX Page Structure

best and most widely used high-level programming languages began, emphasizing the Cromemco tradition of providing the strongest software support for microprocessors. Again, the sixteen-bit computer development project was emphasizing the introduction of a total system, so a broad range of high-level language support was necessary. Languages developed for delivery with the 68000-based hardware include a Macro Assembler, FORTRAN, PASCAL, BASIC, COBOL, and C. Along with the high level languages, applications packages such as the Cromemco MASTER series (a collection of user-friendly tools such as word processing, financial planning, and graphics-preparation programs) are available that run on the system. It is anticipated that a number of application packages that previously required mini or supermini computers as hosts will be made available to run on the 68000-based machine.

Networking

Another important area of concern was the interlinking of a wide variety of different types of computers through Local Area Networks such as the Cromemco C—NET (which is described in Vol. 2, No. 3 of I/O News). One of the strengths of the CROMIX operating system is that it is ideally suited to controlling network functions such as electronic mail, file handling, printer spooling, and integrating low cost terminals based on Z-80 CP/M-like operating systems into a complete distributed processing network, as shown in Figure 4. By tailoring the amount of computational power very closely to the complexity of the task, the overall cost of the data processing function is reduced to its minimal value. The hardware and software of the 68000-based computer family were designed with this in mind.

Summary

The logic functions available on a single silicon chip have grown from the simple binary functions available in the 1960s to the more sophisticated function blocks of the 1970s, including monolithic microprocessors. The eight bit microprocessor has served as the keystone for an entirely new class of electronic tool: the microcomputer. While microcomputers have recently experienced explosive growth in areas such as word processing and small business applications, as well as widespread acceptance as "personal" computers, larger applications such as scientific computation or engineering analysis have traditionally required mainframe or mini computers with a sixteen- or thirty-two-bit central processing unit. Recent advances in the state of the art in integrated circuit design and processing, made possible largely through the use of computer aided design techniques and the proliferation of large computers, have resulted in the development of a new generation of microprocessor integrated circuits which will provide the brain power for a new generation of small computers.

Microcomputer will become a partial misnomer for these new machines because, while their tiny circuits are indeed microscopic, their

Continued next page

Development of a New Family of Computer Products

Continued from page 59

computational power will rival the performance of current mini and supermini computers, and surpass the performance of mainframe computers of just a few years ago.

The development of a new product in a highly competitive industry is always a difficult task, and creating a new computer system is no exception. In addition to the normal competitive pressures of the marketplace, there is a technological risk involved in the choice of processors around which to base the new computer. Selecting a chip which is already technologically outdated or restricted in performance capability locks the product into an inferior position which no amount of marketing hype can overcome. In addition, computer hardware is not a stand-alone product; it is used in conjunction with software instructions and other computers to provide a solution to a particular user's problems.

The investment in existing software often exceeds the investment in hardware. For this reason, particular care must be taken to provide compatibility with existing equipment, not only from the point of view of providing for program exchange with existing sixteen- or thirty-two-bit computers, but also providing for upward compatibility of programs developed on eight bit processors. In addition, the processor hardware is not the only part of the computer system which must be provided. The emphasis is on the use of a system to fulfill a need or solve a problem. Thus a new computer must offer not only sophisticated hardware, but a broad range of software (both operating systems and high level languages) as well. Ancillary hardware and peripherals, such as hard-disk memory storage units and color graphics, offer the ability to expand and grow as the needs of the user change, and also increase the utility of a new computer system to be a systematic solution rather than just another headache for a systems integrator.

Throughout the evolution of this project, Cromemco made every effort to provide the latest technology at cost effective prices. Equally important in our minds was the need to provide compatibility with existing hardware and software as well as to provide easy expandability for the user for both existing hardware and for the next generation of products. Careful consideration of the total system design has resulted in a technologically superior product which also complements (and is compatible with) an existing product line. CD

About the Author

David Mandelkern received the B.S. degree with distinction and the M.S. degree in Electrical Engineering from Stanford University, Stanford, California in 1981. In 1980-81, he was a Research Assistant in the Integrated Circuits Lab, Stanford Electronics Laboratories, working on high voltage capacitive drivers for use in a reading aid for the blind.

In September 1981, he joined the staff of Cromemco, Inc., Mountain View, California, as a Research and Development Planner. In addition to strategic planning, he has been involved in the product development and introduction of the Cromemco C-NET Local Area Network, and the advanced 16/32 bit supermicro computer family of products. Mandelkern is a member of Sigma Xi and the IEEE.

Continued from page 44

mechanical in the printer. If characters are lost at carriage return or the beginning of the lines, it may be a timing problem and nulls may need to be added after a carriage return.

It is also a good way to test for print quality. Put a piece of paper in and let the unit type the same page by wrapping the paper around the platen so that it prints over and over on the same sheet. Check characters for horizontal and vertical alignment. Use ESC to stop. It has helped me many times to trace problems.

Problems With Printers in CROMIX

Several have had problems getting their printers to work when they have gone to CROMIX. The printers I am talking about are Centronix-type parallel printers. CROMIX checks to see if the printer is ready, where CDOS did not. Therefore it is possible to have a printer that works fine under CDOS but sits quietly under CROMIX with all the same hardware. The symptom is usually system "hang up" when doing printer output. Under Version 11 of CROMIX you can do a CNTRL-C to get the system back.

Check the cable from the printer to the computer. The problem is the same whether you are using a PRI or a TU-ART. Be certain that pin 15 of the DB-25 connector is hooked to the ACKNLG or BUSY line of the printer. You can fool the system by connecting it high through a 180 ohm resistor to ground, pin 14. The best is to tie it to the proper line on the printer.

Special Software Needed?

The sales force at Cromemco has been surveying its dealers worldwide to discover the existence of specialized software in use on Cromemco systems. Meanwhile, we have been collecting such information from members since our inception. As soon as all lists can be compiled, we will be able to better answer your questions when you call or write for information.

Speaking of calling or writing for information, most members are now including their membership numbers. This is a big help, and truly aids us. Thank you for remembering.

Continued from page 51

in eliminating clerical labor and materials handling labor.

The total cost savings were estimated as follows:

Savings in Direct Labor $112,530
(1000 units / day x $1.55 / unit x 242 days / year x 30% productivity increase)

Savings in Bundling Time 48,400
(1000 units / day x 242 days / year x $.20 / unit)

Savings in Materials Handling 16,000
(Two people @ $8,000)

Savings in Clerical Labor 15,000

Savings in Inventory in Process 30,100
(28,000 units x $4.30 / unit x 25% carrying cost)

Savings in Floor Space 16,560
(2,760 sq. ft. @ $6.00 / sq. ft.)

Total Direct Savings $238,590

The total installed cost of the automated materials handling system was under $200,000. The above savings are only estimates. Since the firm did not have a very detailed and accurate cost accounting system prior to installation of the new system, it is not possible to accurately measure some of these benefits. It is believed that the above estimates are reasonably accurate. If so, then the entire cost of the automated system can be saved in less than one year.

There are other benefits of unit production not costed above which are substantial, although difficult to measure. Response to orders has been reduced to a small fraction of the previous time. Also, since the workers are paid on a piece rate system, the availability of production information to the worker has a positive motivational effect.

With the magnitude of benefits available with a computer controlled materials handling system, it seems inevitable that there will be many such installations over the next decade, not only in clothing manufacturing, but also in many other types of manufacturing operations.

About the Author

Roger Vergin is President of Conex Electro Systems Inc. and Professor of Business Administration at Simon Fraser University, Burnaby, British Columbia, Canada. He received B.A., M.B.A., and Ph.D. degrees from the University of Minnesota. He previously was a professor at the University of California and the University of Washington, teaching Management Science and Production Management. He has published several books and articles in publications such as Management Science, Journal of Industrial Engineering, California Management Review, and Operations Research Journal.

Conex Electro Systems provides research and development in electronics and computers for other manufacturers and also manufactures its own line of electronic products for the radio industry and the marine industry.

Join Now. But Don't Cut The Page. Copy This Application and Mail to IACU With Your Check.

Application for Membership

Please start my Membership in the International Association of Cromemco Users right away. I have enclosed my
( ) Check ( ) Money Order in the amount of
$_____ for a ( ) year membership.
(U.S. Dollars only please)

☐ International applicants: add $10.00 (U.S.) if you prefer to pay through your local bank.

Membership Rates in the United States:
( ) 1 yr. = $35.00 ( ) 2 yr. = $65.00
( ) 3 yr. = $90.00

Membership Rates in Canada and Mexico:
( ) 1 yr. = $41.00 ( ) 2 yr. = $77.00
( ) 3 yr. = $108.00

Membership Rates in all other countries:
( ) 1 yr. = $48.00 ( ) 2 yr. = $81.00
( ) 3 yr. = $129.00

Name: _____

Title: _____

Company: _____

Mailing Address: _____

_____

City: _____ State: _____

Country: _____ Zip/Postal Code: _____

Phone: _____ _____ _____
Area code number extension

Telex: _____

Now Available in the U.S. and most other countries on your VISA or Mastercard
(U.S. Dollars drawn on U.S. banks only **please**. Please Type or Print Clearly)
( ) VISA/Mastercard _____
(Expiration Date)

_____
(Your Full VISA or Mastercard Number)

Date _____ Signature _____

_____
(Name exactly as it appears on card)

The International Association of Cromemco Users is designed to provide its Members with the information they want. Help us deliver by answering the following questions. You may check more than one block as applicable: My field is:

( ) Professional Services ( ) Engineer: _____
(Accounting, Dentist, Low Medicine. (please specify)
Other: _____ ( ) Home Use
( ) Wholesaler or Distributor ( ) Retail Business
( ) Educational Institution ( ) Government:

_____ _____
(indicate level) (indicate branch)

Effective dates: June 1, 1982 through May 31, 1983

My Primary Uses are:
( ) Business
( ) Business & Personal
( ) Educational
( ) OEM
( ) Personal Only
( ) Process Control
( ) Other: _____
( ) _____
( ) _____

I Want to Know More About the following Packages:
( ) Accounting
( ) Educational (adult)
( ) Educational (child)
( ) Computer Graphics
( ) Inventory Control
( ) Investments
( ) Home Economics
( ) Medical Research
( ) Process Control
( ) Sports & Games
( ) Other: _____
( ) _____
( ) _____

Describe Your Present System: (use brands and model numbers)
Computer: _____
Memory: _____
I/O: _____
Disk: _____
Terminals: _____
Printers: _____
Other: _____
_____

List Software Now in Use: (Packages, Special Operating Systems, etc.)
_____
_____
_____
_____

What Types of Software Would You Like to know more about?
_____
_____
_____

Would you be interested in preparing an article of interest to members?
☐ Yes
Subject Matter: _____
_____
_____

☐ I've included an additional $8.95 for my reference binder (including first class postage in U.S., Canada & Mexico. International purchasers, please add $2.00 [U.S.] extra for postage.)
☐ Please send information pertaining to my exclusive IACU group insurance privileges (U.S. only)
☐ Reserve a Periodic Software Applications Guide for me at the Members-only pre-publication price (to be announced prior to publication).

Mail Your Membership Application to:
The International Association of Cromemco Users
P.O. Box 17658, Irvine, CA 92713 U.S.A.
For more information, call (714) 955-0432

Continued from page 25

```
;
mainlp: ld      b,5
go_on:  push    bc
        ld      de,arglms
        call    prnbf$
        ld      b,4             ;set up to input four hex digits.
        ld      hl,stor1        ;point to storage for input.
        ld      d,'0'
        ld      e,'F'
        call    gTLN1$
        ld      a,(hl)          ;get number of chars. to input.
        ld      de,0
        ld      e,a             ;load this number into de,
        add     hl,de           ;and add to hl so we point to
        inc     hl              ;end of input.
        ld      a,'H'
        ld      (hl),a          ;set up string for ahex.
        ld      de,arg2ms
        call    prnbf$
        ld      b,4             ;set up to input four hex digits.
        ld      hl,stor2        ;point to storage for input.
        ld      d,'0'
        ld      e,'F'
        call    gtln1$
        ld      a,(hl)          ;get number of chars input.
        ld      de,0
        ld      e,a             ;load this number into de,
        add     hl,de           ;and add to hl so we point to
        inc     hl              ;end of input.
        ld      a,'H'
        ld      (hl),a          ;set up string for ahex.
;
;Convert the input arguments into binary, and load into locations 6100h
;and 6200h for the 68000.
;
        ld      bc,stor1+1
        call    ahex            ;call ahex (in asmlib).
        ld      c,h
        ld      b,1             ;want to store hi byte first for 68000.
        ld      (6100h),bc
        ld      bc,stor2+1
        call    ahex            ;convert to binary.
        ld      c,h
        ld      b,1
        ld      (6200h),bc
;
;Zero out area into which answer is to be placed.
;
        ld      b,4
        xor     a
        ld      hl,1000h
nul:    ld      (hl),a
        inc     hl
        djnz    nul
;
;Save CDOS low memory and reinitialize addrs. 0h thru 7h for reset
;sequence of 68000 --  register a7 is loaded with four bytes begining
;at 0h; the program counter is loaded with the next sequential four bytes.
;
        ld      de,700h         ;save CDOS low memory.
        ld      hl,0
        ld      bc,0ffh
        ldir                    ;move memory.
        ld      hl,0            ;init addrs. zero for 68000 stack.
        ld      a,0
        ld      b,6
loop:   ld      (hl),a
        inc     hl
        djnz    loop            ;init 03h for 68000 program counter.
        ld      a,60h
        ld      (hl),a
        inc     hl
        xor     a
        ld      (hl),a
;
;Turn on 68000 processor to do the multiply and place the result at
;1000h.  This is done by firmware on the DPU whenever the Z-80 does
;an I/O output to port 0FFh. It outputs 1 to turn on the DPU.
;
        ld      a,1
        out     0ffh,a          ;turn on 68000
        ld      de,0            ;if we get back, restore CDOS low memory
        ld      hl,700h         ;so we can do system calls.
        ld      bc,0ffh
        ldir


;
;Convert result of multiplication to ASCII and output it.
;
        ld      hl,string
        ld      a,(1000h)
        call    binh2           ;binary to ASCII conversion (in Asmlib).
        ld      hl,string+2
        ld      a,(1001h)
        call    binh2
        ld      hl,string+4
        ld      a,(1002h)
        call    binh2
        ld      hl,string+6
        ld      a,(1003h)
        call    binh2
        ld      de,answer
        ld      c,9
        call    5
        ld      de,700h         ;save CDOS low memory.
        ld      hl,0
        ld      bc,0ffh
        ldir                    ;move memory
        pop     bc
        dec     b
        jp      nz,go_on
        ld      de,contin
        call    prnbf$
        ld      c,80h           ;don't echo input.
        call    5               ;call CDOS
        cp      0dh
        jp      z,mainlp        ;hitting any key but <RET> will exit.
        jp      0
;
        list    text
;
msg:    db      0ah,0dh,0ah,0dh,'  This program prompts for two hex numbers'
        db      ' in the range 0h-FFFFh.',0ah,0dh
        db      '  Only the digits 0-9 and A-F (caps only) give proper'
        db      ' results.',0dh,0ah,'  The answer is displayed in hex.'
        db      0ah,0dh,'  Out-of-range input produces unexpected answers.'
        db      0dh,0ah,'  After any five multiplies, you may exit.'
        db      0dh,0ah,0dh,0ah,'$'
answer: db      0dh,0ah,0dh,0ah,'  Your answer, expressed'
        db      ' in hexidecimal is  >>  '
string: ds      8
        db      0dh,0ah,0dh,0ah,'$'
arglms: db      0dh,0ah,0dh,0ah,'  Input first'
        db      ' hex argument (digits 0-F)  >>  ','$'
arg2ms: db      0dh,0ah,'  Input second hex argument (digits 0-F) >>  ','$'
stor1:  ds      6
stor2:  ds      6
contin: db      0dh,0ah,0dh,0ah,'  To continue, hit <RETURN>. '
        db      ' Any other key exits.'
        db      0dh,0ah,0dh,0ah,'$'
        db      '$'
```

```
;The following 68000 program looks for values to multiply together in
;addresses 6100h and 6200h.  The values are placed there by
;the Z-80 processor.  The result of the multiplication is placed in
;location 1000h to 1003h.  These comments are what the 68000 assembly code
;would look like, but if you don't have the 68000 Assembler you can
;hand assemble the program as was done in this example.
;
;       org     6000h
;start: move    6100h,d0        ;get 16 bit value into d0.
;       mulu    6200h,d0        ;do unsigned multiply from memory
;                               ;to data register.
;       move.l  d0,1000h        ;store long word result back
;                               ;into memory.
;
;The next line moves the value at 6500h to 80FFh.  The value is 0,
;and was placed there by the Z-80.  The address 80FFh is sign extended
;by the 68000 and so represents absolute address FFFF80FFh.  This resides
;in the top-most 64k bytes of the 68000 address space.  The DPU firm-
;ware is designed to interpret any address access in this top 64k
;space as an I/O access.  It is turned into an input or output to
;hardware ports - in this case, port 0FFh.  In effect this outputs
;zero to port 0FFh.  Doing this turns off the 68000 processor and
;at the same time turns on the Z-80.  That is, we may return control
;to the Z-80 in this way.
;This technique for I/O is used becaues the 68000 is memory mapped.
;
;       move.b  6500h,80FFh     ;output contents of 6500h to port 0FFh.
;
;Next line will be executed the next time that the Z-80 turns
;on the 68000.  For this example, this will be an absolute
;jump to the begining of this 68000 program.
;
;       jmp     6000h
;
;       end     start
;
;Stored at the label "prog68" is the machine code represented by
;the above program segment.  This code is moved by the Z-80 to
;address 6000h.  Before turning on the 68000, the value
;00006000h is placed at address 4h,5h,6h,7h.  After reset, the
;68000 will load its program counter from these addresses the first
;time it is turned on.  These addresses MUST BE initialized before
;transfering control to the 68000.  If not, whatever happens to be
;at 4h,5h,6h,and 7h will go into the 68000 program counter and
;the 68000 will begin executing where ever the pc is pointing.
;
prog68: db      30h,38h,61h,0,0c0h,0f8h,62h,0,23h,0c0h,0,0,10h,0
        db      11h,0f8h,65h,0,80h,0f6h,4eh,0f9h,0,0,60h,0
count:  dl      $-prog68
;
        end     start
;To compare the speed of the 68000 with the Z-80 we can use a multiplication
;example.  The following is a multiply program that runs on the 68000
;processor.  It is called 250 times from the Z-80 and thus multiplies 500,000
;two byte integers, returning a full precision four byte result.  The
;time elapsed is about 12.25 seconds.
;
                0001  ;
(00004000)      0002  arg1:     equ     4000h   ;1st arg. list
(00005000)      0003  arg2:     equ     5000h   ;2nd arg. list
(00004000)      0004  stack:    equ     4000h   ;dest. for results
(000007D0)      0005  count:    equ     2000d   ;number of entries
                0006  ;
000000 303C 07D0 0007  start:   move    #count,d0 ;loop control
000004 207C 0000 4000 0008             move.l  #arg1,a0  ;a0 points to list 1
00000A 227C 0000 5000 0009             move.l  #arg2,a1  ;a1 points to list 2
000010 2E7C 0000 4000 0010             move.l  #stack,a7 ;a7 is stack pointer
000016 3218           0011  loop:      move    (a0)+,d1  ;d1 acts as accum.
000018 C2D9           0012             mulu    (a1)+,d1  ;do multiply
00001A 2F01           0013             move.l  d1,-(a7)  ;load result into stk
00001C 5340           0014             subq    #1,d0     ;dec. loop control
00001E 66F6           0015             bne     loop      ;stop after 2000
                      0016             end     start     ;iterations.
;
;A comparable program running on the Z-80 and doing CDOS call 89h -- multiply
;integers -- takes 155 seconds to do 200,000 multiplies.  However the answer
;is returned in the DE register pair, truncated to two byte integers.
;
;Thus for this specific application, we compare the hardware 68000 multiply
;with a software multiply routine and find an increased throughput of 31
;times (discounting the disadvantage of the two byte result using the Z-80,
;which makes the 68000 look even better!).
;
```


About The Authors

John D. Bridgman is the assembler and FORTRAN specialist in the software section of CROMEMCO's Customer Support Department. He is a graduate of U.C. Berkeley and has a B.S. degree in Computer Science from San Francisco State University.

Michael Betts is the Customer Service Department Software Support Manager at Cromemco. He is a graduate of Rensselaer Polytechnic Institute in New York, and previously worked as a systems analyst for Planning Research Corp.

Putting Your Data Files in Order

Continued from page 13

About the Author

LT. COL. JAMES R. GUNKEL is a Program Manager for the United States Air Force, dealing with the acquisition of simulation devices for the miliary. He holds a B.S. Degree in Chemical Engineering from Arizona State University, and has earned Masters Degree credits in Operations Research/Computer Science. Jim is anticipating a second career in the field of computing when he retires from the USAF in two years. He has indicated that he can make several programs listed below, available to members of IACU for nominal copying charges. All are available on either 5¼" or 8" floppy disks.

Programs available:

BITMAP—SOURCE AND .COM FILES
COPYDISK—SOURCE AND .COM FILES
MENU—SOURCE AND .COM FILES
DRIVERS—EXPANDED TO INCLUDE
  SOROC 120
  MICROTHERM ACT IV
  HEATHKIT 19 (NOT FINAL)
REPEN—DBMS REPORT GENERATOR IN 16K BASIC

The programs can be ordered from:

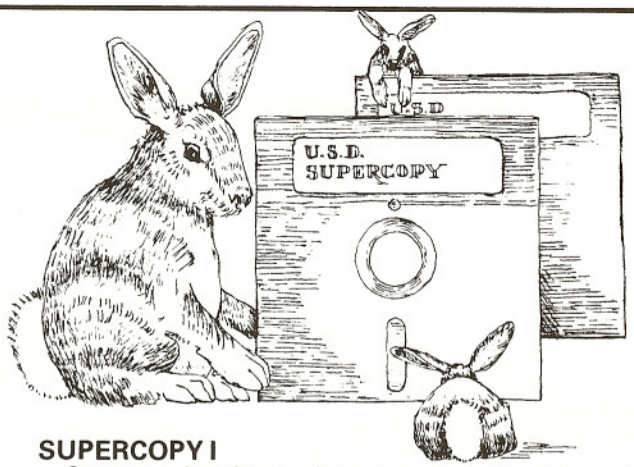
MICRO COMPUTER CENTER
7900 Paragon Road
Centerville, Ohio 45459
Phone: (513) 435-9355

TRW Service Now Available in 31 Metro Areas

The previously announced (Vol. II No. 2) implementation of service programs for Cromemco Systems by TRW Service Techs is now in effect in 31 U.S. metropolitan areas. The initial locations are:

Albuquerque	505/884-3630
Atlanta, GA	404/449-5906
Austin, TX	512/458-6011
Birmingham, AL	205/870-0600
Boston, MA	617/890-5600
Bridgeport, CN	203/384-0068
Chicago, IL (North	312/884-0800
Chicago, IL (South)	312/986-6430
Cleveland, OH	216/243-4055
Dallas, TX	214/630-2640
Denver, CO	303/388-6307
Detroit, MI	313/569-4113
Harrisburg, PA	717/761-1997
Houston, TX	713/462-7474
Kansas City, MO	816/753-2578
Los Angeles, CA	213/483-4800
Memphis, TN	901/345-6475
Miami, FL	305/624-0309
Minneapolis, MN	612/484-8319
New York City, NY	212/953-9500
New Jersey - Northern	201/379-7300
New Jersey - Southern/ (Philadelphia Metro)	609/764-9082
Oklahoma City, OK	405/949-0108
Orlando, FL	305/894-4641
Phoenix, AZ	602/244-9785
Raleigh, NC	919/821-4655
San Diego, CA	714/297-4015
San Francisco, CA	415/352-6557
Seattle, WA	206/641-6660
St. Louis, MO	314/872-9342
Tampa, FL	813/879-1950
Washington, DC	301/459-2070

More than 60 TRW service specialists have completed a technical training course at Cromemco, and more are currently receiving training in the field from TRW training supervisors.



SUPERCOPY

USD offers two FAST copy utilities, SUPERCOPY I & SUPERCOPY II. Either version produces fully-verified, error-free diskette duplicates with amazing speed—less than 140 seconds for an 8" DSDD 1.2 megabyte diskette.

SUPERCOPY I

Supercopy I copies any Cromemco diskette while operating under Cdos, including CROMIX diskettes. Provides readout of errors and their locations, should they occur. Many options.

SUPERCOPY II

Copies and/or Initializes any Cromemco diskette while operating under Cromemco Cdos OR Cromix. Uses extensive automatic error handling techniques to produce error-free copies with or without operator intervention. Many options are available, all of which may be customized during initial use for future automatic operation. The ultimate diskette duplication utility for both Cdos and Cromix. Allows duplication of previously "uncopyable" diskettes.

WHAT YOU GET

Supercopy I or Supercopy II on 5 or 8 inch SSSD diskette, comprehensive Users Guide, one year's free software support.

SYSTEM REQUIREMENTS

Cromemco computer operating under Cromemco Cromix or Series 2 Cdos.

WHAT IT COSTS:
- SUPERCOPY I — $49.50
- SUPERCOPY II — $95.00
- New York residents add 7%
- Make checks payable to U.S. Dynamics Corp.

RESTORE

ERASED THAT IMPORTANT HARD DISK FILE? RESTORE IT IN SECONDS WITH USD's RESTORE.

WHAT YOU GET

Restore.Com and Edir.Com on SSSD 5¼ or 8 inch diskette, comprehensive Users Guide, one year's free software support.

WHAT IT DOES

Restore.Com restores erased files on Cromemco's hard disks (HDD-11, HDD-22, Z2-H, etc.) or any Cromemco floppy diskette.

Edir.Com displays an alphabetical directory of ERASED entries.

SYSTEM REQUIREMENTS

Cromemco computer operating under series 2 Cdos (version 2.xx).

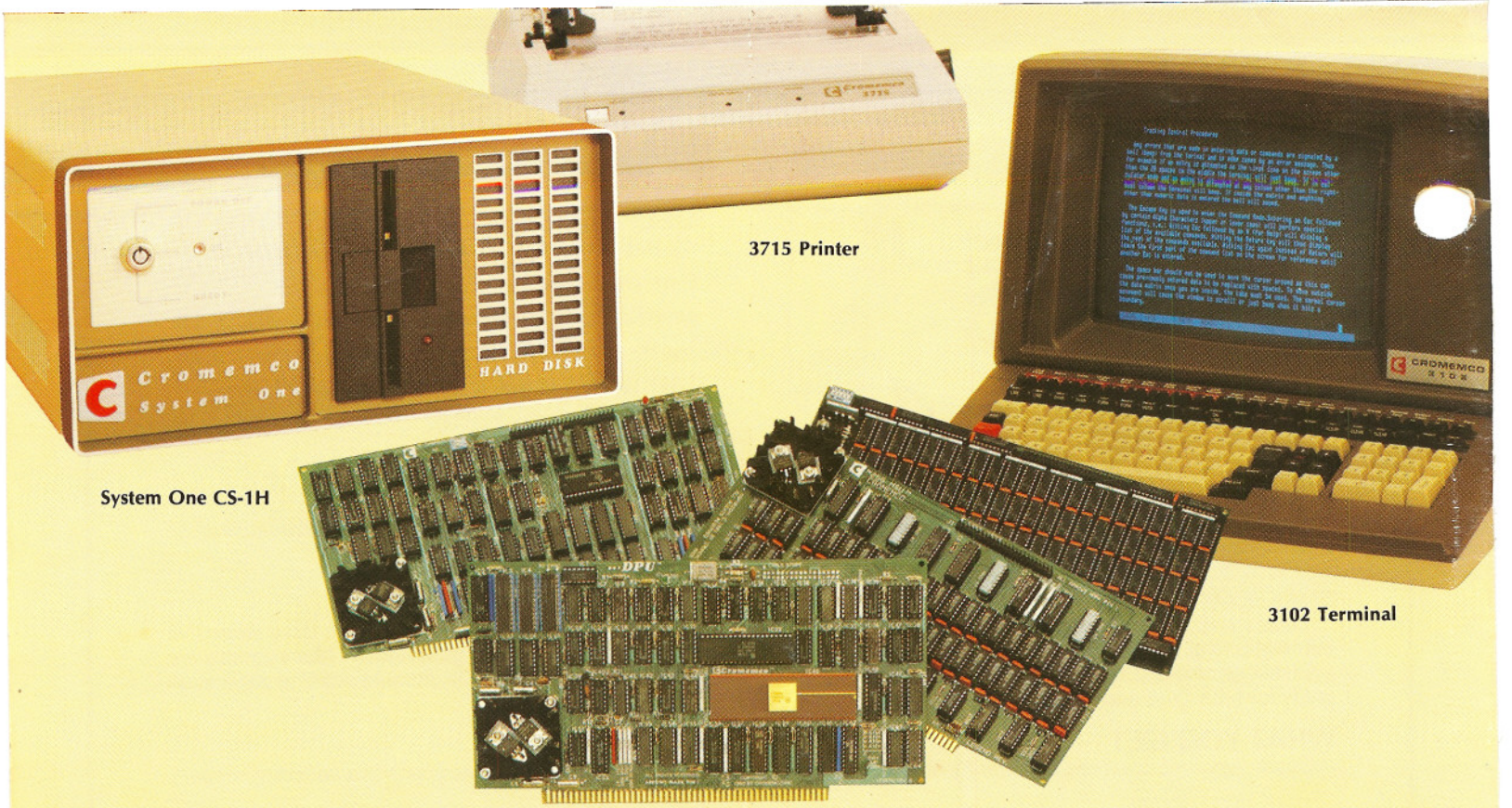
WHAT IT COSTS:
- $95.00 For immediate air mail shipment.
- New York residents add 7%
- Make checks payable to U.S. Dynamics Corp.

For INFORMATION or SUPPORT: Call collect.
Ask for software engineering.
We accept Visa and MasterCharge

30 YEARS AT THE USD LEADING EDGE

HOW TO ORDER
Call collect or write. If calling, place calls during normal business hours, EST. Ask for software sales.

U.S. DYNAMICS CORPORATION 425 BAYVIEW AVE., AMITYVILLE, NEW YORK 11701 (516) 842-5600



3715 Printer

System One CS-1H

3102 Terminal

DPU card with error-correcting memory and controller cards

POWERFUL NEW MICRO. POWERFUL SOFTWARE.

68000-POWERED FOR TOMORROW

Once again you get a big stride forward with Cromemco.

This time it's our new DPU Dual Processor Unit. It gives enormous power to Cromemco computer systems such as our System One shown here.

COMPARES WITH MAINFRAMES

With the new DPU you get the almost unbelievably powerful 68000 processor and its 32-bit data-handling capabilities combined with its **16 Megabyte** address space.

In other words with the System One/DPU combination you get a small machine that's the equal of superminis and mainframes in some areas.

8-BIT AND 68000 SOFTWARE

The dual part of the DPU refers to its on-board Z-80A processor. With this you have access to existing CP/M* software.

But besides being compatible with this wealth of existing 8-bit software, the System One/DPU has available a whole family of new 68000 system software. This includes a wide range of high-level software such as our 68000 Assembler, FORTRAN 77, Pascal, BASIC, COBOL, and C.

Beyond all this there's a version for the 68000 of our widely admired CROMIX† Operating System. It's like UNIX‡ but has even more features and gives multi-tasking and multi-user capability. In fact, one or more users can run on the Z-80A processor while others are running on the 68000. Switching between the Z-80A and 68000 is automatically controlled.

The System One itself is a bus-oriented machine that has options for color graphics, for 390K or 780K of floppy storage, a 5 MB hard disk option, communications capability, and multi-processor capability using our I/O processor card.

HIGHLY EXPANDABLE

With the System One/DPU combination, you get tremendous expandability. Right now you can have up to 2 MB of RAM storage. You get this with our new Memory Storage cards and our Memory Controller. The Controller fully supports the 16 MB storage space of the 68000, allowing you vast future expansion capability.

Further, the memory has built-in **error detection** and **correction,** a feature normally found only in much more costly systems.

Present customers can field-upgrade their Cromemco systems to use the DPU and still be able to run their present software using the Z-80A on the DPU. It's one more instance of Cromemco's policy of providing obsolescence insurance for Cromemco users.

LOW PRICED

With all this performance you might not be ready for the low price we're talking about. With 256K of RAM and 780K of floppy storage, the price of the System One/DPU is only $5495. Yes, that's hard to beat.

So contact your rep now. He'll fill you in on the many more features that this outstanding and powerful machine offers.

*CP/M is a trademark of Digital Research
†CROMIX is a trademark of Cromemco, Inc.
‡UNIX is a trademark of Bell Telephone Laboratories

Cromemco™
incorporated
280 BERNARDO AVE., MOUNTAIN VIEW, CA 94040 • (415) 964-7400
Tomorrow's computers today